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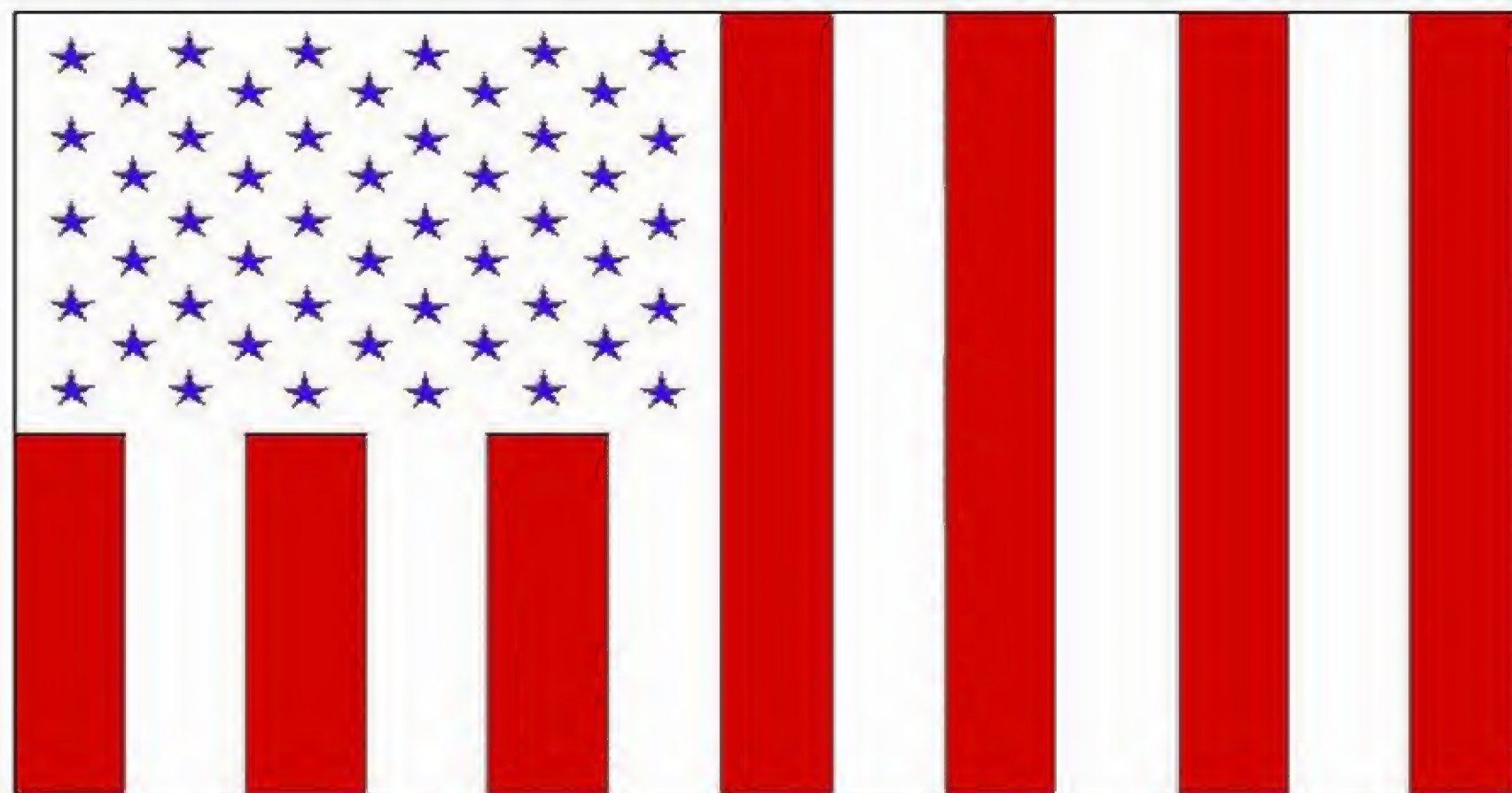
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TM 9-743

RESTRICTED

WAR DEPARTMENT

TECHNICAL MANUAL

LIGHT ARMORED CAR M8

MARCH 10, 1943

RESTRICTED

TECHNICAL MANUAL }
 No. 9-743 }

WAR DEPARTMENT
 Washington, March 10, 1943

LIGHT ARMORED CAR M8

Prepared under the direction of the
 Chief of Ordnance

(with the cooperation of the Ford Motor Company)

CONTENTS

PART ONE — Operating Instructions

SECTION		Paragraphs	Pages
I.	Introduction	1- 5	3-10
II.	Operation and controls.....	6- 12	11-22
III.	Operation under unusual conditions	13- 18	23-24
IV.	Armament	19- 21	25-27
V.	Preventive maintenance and inspections.....	22- 27	28-32
VI.	Lubrication	28- 31	33
VII.	General care and preservation....	32- 33	34-35
VIII.	Equipment and tools on vehicle	34- 35	36-42
IX.	Materiel affected by chemicals....	36- 39	43-46

PART TWO — Organization Instructions

X.	General information on maintenance	40	47-55
XI.	Equipment and special tools.....	41- 42	56
XII.	Organization spare parts and accessories	43- 44	57
XIII.	Engine	45- 58	58-74

LIGHT ARMORED CAR M8

PART TWO — Organization Instructions — (Cont.)

	Paragraphs	Pages
SECTION XIV. Ignition system	59- 65	75-80
XV. Fuel system	66- 75	81-89
XVI. Cooling system	76- 83	90-95
XVII. Electrical system	84-112	96-115
XVIII. Nonelectrical instruments	113-114	116-118
XIX. Clutch	115-123	119-123
XX. Propeller shafts and universal joints	124-125	124-126
XXI. Transmission	126-128	127-128
XXII. Transfer case	129-131	129-130
XXIII. Axles	132-137	131-137
XXIV. Springs, bogies, and shock ab- sorbers	138-143	138-141
XXV. Steering gear	144-147	142-143
XXVI. Wheel and tires	148-152	144-146
XXVII. Brakes	153-166	147-153
XXVIII. Hull and turret	167-175	154-157
XXIX. Painting	176-181	158-161
XXX. References	182-183	162-165
INDEX		166-177

PART ONE — Operating Instructions

Section I

INTRODUCTION

	Paragraph
Scope	1
Content and arrangement of the manual	2
References	3
Description	4
Tabulated data	5

1. SCOPE.

a. This technical manual is intended to serve temporarily (pending the publication of a more complete revision) to give information and guidance to the personnel of the using arms charged with the operation, maintenance, and minor repair of this materiel.

2. CONTENT AND ARRANGEMENT OF THE MANUAL.

a. Sections I through IX contain information chiefly for the guidance of operating personnel. Sections X through XXIX contain information intended chiefly for the guidance of personnel doing maintenance work.

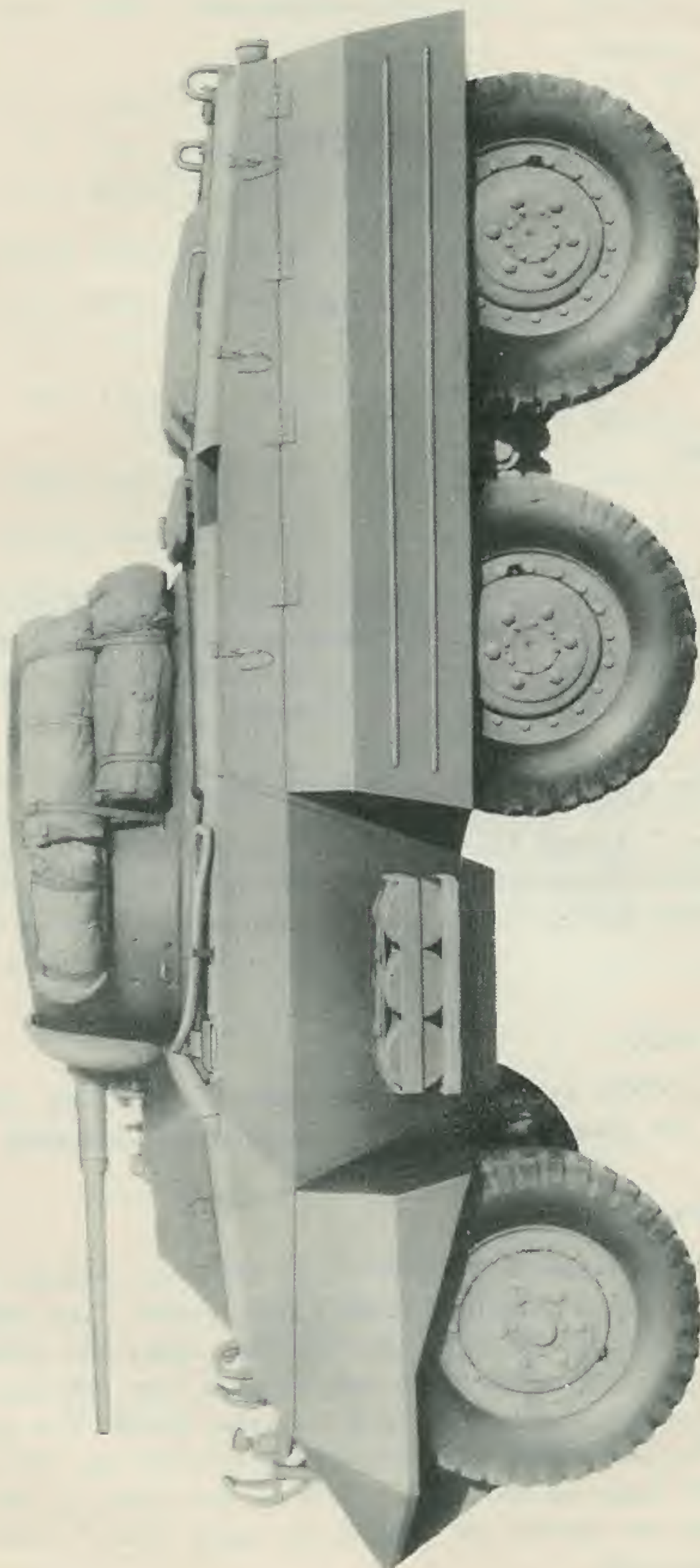
3. REFERENCES.

a. Section XXX lists all standard nomenclature lists, technical manuals, and all other publications for the materiel described herein.

4. DESCRIPTION.

a. The Light Armored Car M8 is an armored, 6-wheel (6 x 6) vehicle powered by a Hercules model JXD engine. The engine is located in the rear of the hull. The operator steers the vehicle by means of a steering gear with the conventional type steering wheel. The vehicle has 8 forward speeds and 2 reverse speeds. The armored car is wired for radio installation within the armored car. The armor is on a $\frac{7}{8}$ -inch basis on the front and is $\frac{3}{8}$ inch thick on the sides. The turret can be rotated 360 degrees by hand. The 2 turret seats rotate with the turret.

LIGHT ARMORED CAR M8



RA PD 27993

Figure 1 — Left Side View of Light Armored Car M8

INTRODUCTION

5. TABULATED DATA.

a. General.

Length, over-all (approx.).....	185 in.
Width, over-all (approx.).....	91 in.
Height, over-all (approx.).....	75 in.
Gross weight, with equipment and crew (approx.).....	16,400 lb

	Front	Rear
Ground pressure, hard road, zero penetration.....	60 psi	50 psi
Ground pressure, with 4-in. penetration.....	12.5 psi	10.5 psi
Ground pressure, with 8-in. penetration.....	9.8 psi	8.5 psi

Load distribution:

Front axle, with equipment and crew.....	6,000 lb
Rear axle and intermediate axle,* with equipment and crew (each)	5,200 lb

Wheel base:

Front to intermediate axle.....	80 in.
Front to rear axle.....	128 in.

Tread:

Front	76 in.
Rear	76 in.

Turning radius	27 ft
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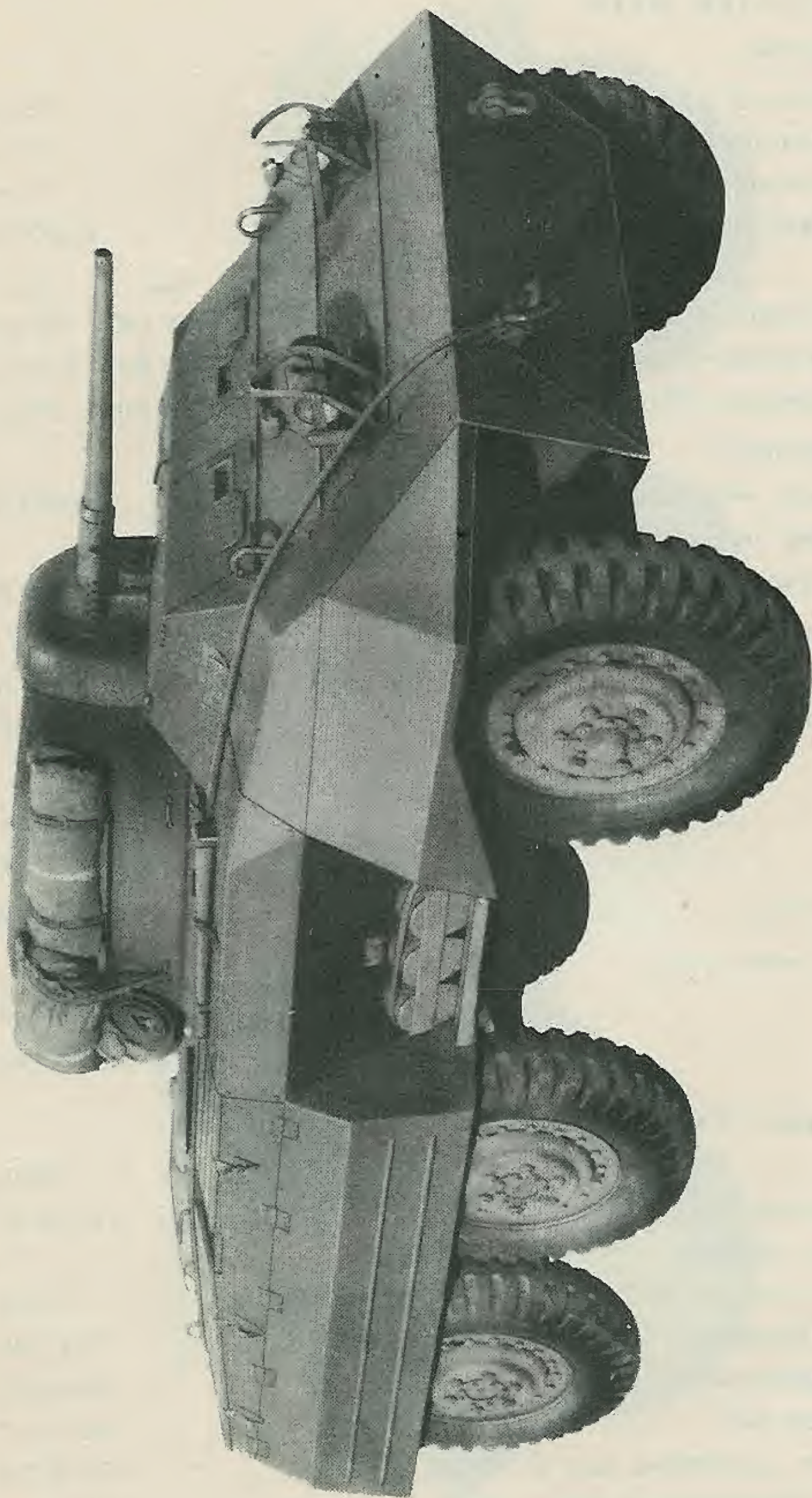
Clearance under axles:

Front	11.4 in.
Rear	11.4 in.

b. Engine (Hercules model JXD).

Weight	750 lb
Bore and stroke.....	4 x 4 1/4 in.
Number of cylinders.....	6
Developed horsepower (at 3,000 rpm).....	110 hp
Maximum torque (at 1,100 rpm).....	238 ft-lb
Piston displacement	320 cu in.
Compression ratio	6.5 to 1
Firing order (numbered rear to front).....	1-5-3-6-2-4
Maximum recommended engine speed.....	3,200 rpm

LIGHT ARMORED CAR M8



RA PD 27994

Figure 2 — Right Front View of Light Armored Car M8

INTRODUCTION

RA PD 27995

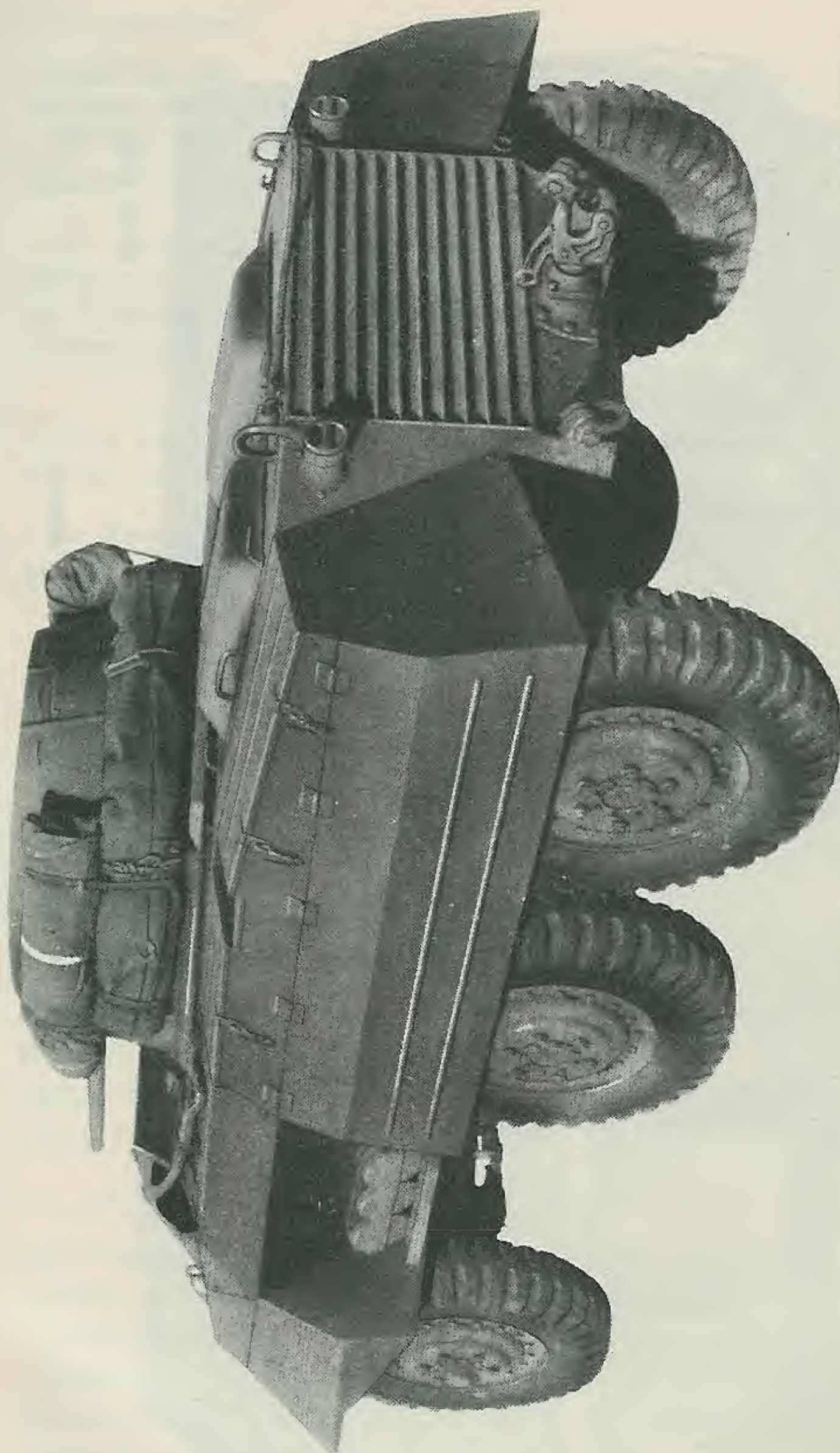
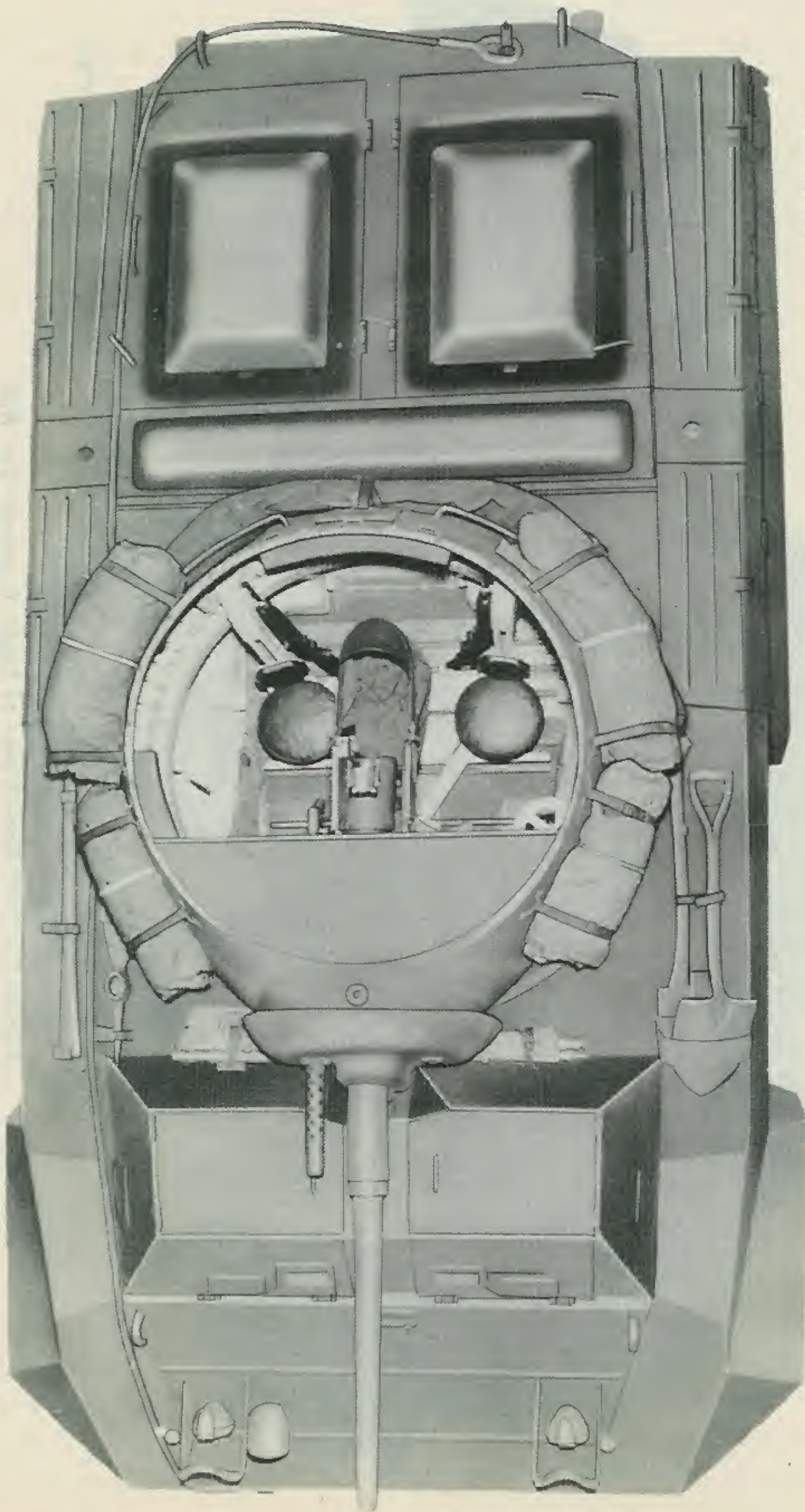


Figure 3 — Left Rear View of Light Armored Car M8

LIGHT ARMORED CAR M8



RA PD 27996

Figure 4 — Light Armored Car M8 from Above

INTRODUCTION

c. Armament.

37-mm Gun M6	}	Combination Turret Mount M23A1
Browning Machine Gun, cal. .30, M1919A4, flexible		
Machine Gun Tripod Mount, cal. .30, M2		

d. Protected Vision. Protected vision is provided for the driver and assistant driver by the use of steel shutters (open and shut type) at the 4 vision slots and by indirect vision devices called protectoscopes. A telescope sight is provided for the gunner.

e. Seats. Round, padded seats are provided for the gunner and loader. Padded seats equipped with padded backs are provided for the driver and the assistant driver. These are equipped with safety belts.

f. Protective Padding. The protectoscopes and the gun sight are padded to protect the crew from injury.

g. Communication.

Radio (see par. 34 a (6) for optional equipment):

SCR 508	Sending and receiving
Voice	15-25 miles
Code	30-45 miles
Telephone	Intracar speaking tube

h. Armor Thickness.

Hull front slope.....	5/8 in.
Hull top	1/4 in.
Hull sides	3/8 in.
Hull bottom	None
Turret (cast armor).....	7/10 in.

i. Fuel and Oil.

Fuel capacity	54 gal
Number of miles without refueling:	
Cross-country	100 to 250 miles
Highway	200 to 400 miles
Octane rating of fuel.....	70 or higher
Engine oil capacity (use bayonet gage).....	7 qt
Lubrication	See lubrication chart

LIGHT ARMORED CAR M8

j. Performance.

Maximum sustained speed on hard road.....	55 mph
Expected cross-country speed for various terrains.....	4 to 55 mph
Minimum engine idling speed.....	500 rpm
(600 rpm idling speed recommended to obtain generator high charging rate)	

k. Limitations of Vehicle. The engine of the Light Armored Car M8 is not governed, and it is each driver's responsibility to see that the engine is not abused by high engine speeds, particularly in the lower gears. The following are the maximum speeds allowable and are not to be exceeded:

Maximum allowable speeds with transfer case in low ratio:

First and reverse gears.....	4 mph
Second gear	8 mph
Third gear	16 mph
High gear	28 mph

Maximum allowable speeds with transfer case in high ratio:

First and reverse gears.....	8 mph
Second gear	15 mph
Third gear	32 mph
High gear	56 mph
Maximum grade ascending ability (approx.).....	60 percent
Maximum fording depth at slowest forward speed (approx.).....	32 in.

l. Crew.

Number of men.....	4
--------------------	---

m. Tires.

Type	Combat
Size	9.00 x 20
Plies	12
Inflation pressure:	
Front	60 lb
Rear	50 lb
Capacity per tire (65-lb inflation).....	3,450 lb
Revolutions per mile.....	520
Rolling radius, inflated.....	19.5 in.
Loading rolling radius, with zero inflation.....	17.8 in.
Tread design.....	Nondirectional, mud and snow
Normal clearance between tire and fender.....	7 in.

Section II

OPERATION AND CONTROLS

	Paragraph
General information on controls.....	6
Prestarting inspection.....	7
Starting instructions.....	8
Engine test.....	9
Operating the vehicle.....	10
Stopping the engine.....	11
Towing.....	12

6. GENERAL INFORMATION ON CONTROLS.

a. **Definition of Terms "Left" and "Right."** In all instances throughout this book, "left" or "right" is as viewed from the rear of the armored car when facing the same direction as the car is headed.

b. **Instrument Panel** (fig. 5). The instrument panel is located directly in front of the driver and consists of the following items:

(1) **LIGHT SWITCH** (A, fig. 5). The knob on the instrument marked "LIGHTS" controls the service lights and the blackout driving lights. A spring-operated safety button prevents the knob from being accidentally pulled out beyond the blackout position. To release, push button in with thumb, at the same time continuing outward pull on knob with first and second fingers. In addition to "OFF," the switch has 3 positions, controlling lights as follows:

(a) *Blackout, First Position.*

Lights Operating	Location
Blackout marker lights	Top of right and left headlights
Blackout taillights	Lower section, right and left taillights
Blackout stop light (when brake pedal is depressed)	Upper section, right-hand taillight

(b) *Service, Second Position.*

Service headlights	Right- and left-hand lights
Service stop light (when brake pedal is depressed)	Upper section, left-hand taillight
Service taillight	Upper section, left-hand taillight

(c) *Stop Light, Third Position.*

Service stop light (when brake pedal is depressed)	Upper section, left-hand taillight
--	------------------------------------

LIGHT ARMORED CAR M8

(2) **VOLTMETER (B, fig. 5).** A voltmeter, having a range from 8 to 16 volts, is provided on the instrument panel. When the ignition switch is on the "OFF" position, the voltmeter will read below the first mark. When the ignition is on the "ON" position, the voltmeter should read battery voltage (approximately 12 volts). If the reading is low when the engine is running and no electric energy is being used, the batteries are low in charge and must be recharged. At normal operating speeds during normal temperature, the voltage should not exceed 15 volts. If the reading is greater than this, the generator regulator is not properly limiting the voltage and must be replaced in order to prevent damage to the generator.

(3) **INSTRUMENT PANEL LIGHTS (C, fig. 5).** Two instrument panel lights are used to provide illumination for the various gages. Each of the lights is covered with a round, pronged, button-light cover that is pried out to gain access to the bulb. The instrument panel lights are turned on or off, and the degree of illumination is controlled by the 5-position rheostat (J, fig. 5), located at the right-hand side of the panel.

(4) **CIRCUIT BREAKERS (D, E, and F, fig. 5).** Three circuit breaker buttons are provided at the top in the center of the instrument panel and control the 3 circuit breakers which take the place of the conventional fuses. In each instance, when these circuits are overloaded, the circuit breaker will open. The circuit involved is then closed by pressing the correct button. The circuits controlled by the 3 buttons are as follows:

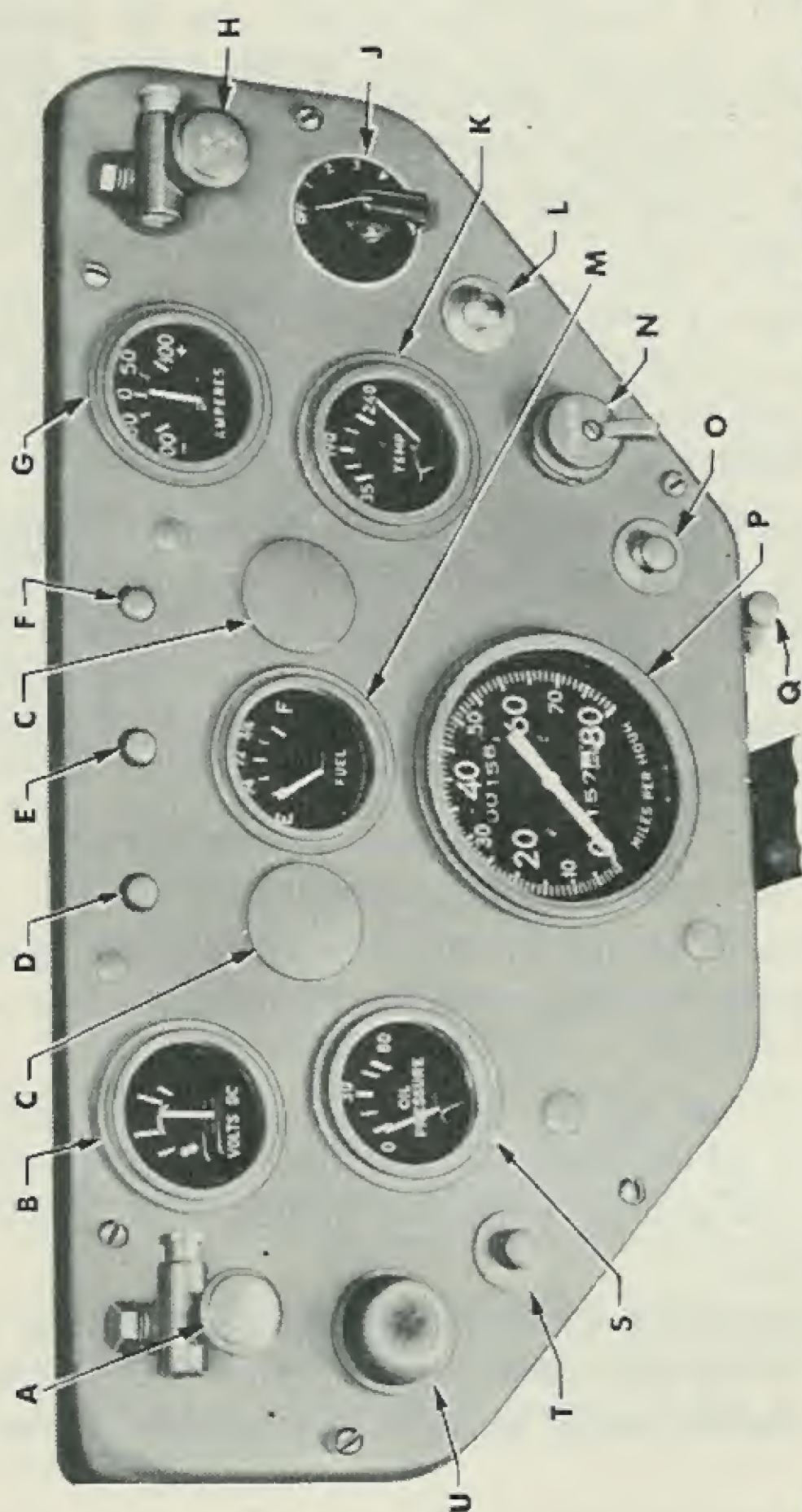
(a) One circuit breaker (D, fig. 5) controls the siren and voltmeter circuits.

(b) A second circuit breaker (E, fig. 5) controls the instrument lights, headlight and taillight circuits.

(c) A third circuit breaker (F, fig. 5) controls the circuits for the various electrically operated instruments and the fire detector circuit.

(5) **AMMETER (G, fig. 5).** The ammeter is provided with a range of 100-ampere discharge to 100-ampere charge. If during normal operations and when little current is being used, the ammeter consistently indicates discharge, the generator regulator is not functioning properly or the generator is at fault. In either case, the batteries are not being charged and will quickly discharge. Check these units frequently to prevent failure during operation. Even when no electrical energy is being used, the ammeter should never go above 50 amperes. If the ammeter indicates more than 50-ampere charge, the current limiting unit in the generator regulator is at fault (par. 85 d).

OPERATION AND CONTROLS



- | | |
|--|--------------------------------------|
| A —LIGHT SWITCH | N —IGNITION SWITCH |
| B —VOLTMETER | O —STARTER SWITCH |
| C —INSTRUMENT PANEL LIGHTS | P —SPEEDOMETER |
| D —CIRCUIT BREAKER SIREN AND
VOLTMETER CIRCUITS | Q —TRIP MILEAGE RESET |
| E —CIRCUIT BREAKER INSTRUMENT LIGHTS,
HEAD LIGHT AND TAIL LIGHT CIRCUITS | S —OIL PRESSURE GAGE |
| F —CIRCUIT BREAKER INSTRUMENTS AND
FIRE DETECTOR CIRCUITS | T —FIRE DETECTOR TEST BUTTON |
| | U —FIRE DETECTOR SIGNAL LIGHT |
- RA PD 27997

Figure 5 — Instrument Panel

LIGHT ARMORED CAR M8

(6) **BLACKOUT DRIVING LIGHT SWITCH (H, fig. 5).** The blackout driving light may be used to supply illumination for driving when reflections from the service driving lights might reveal the position of the vehicle. First, remove both service head lamps from their sockets at the front of the car, and then insert the blackout driving light; pull out the master light switch to first position and pull out the blackout driving light switch button. The blackout head lamps, marker lamps, tail lamps and stop light (when the brake pedal is depressed) will also be on with switches in this position. **CAUTION:** Under battle conditions, use the blackout driving light intermittently and only when absolutely necessary for safe vision.

(7) **INSTRUMENT PANEL LIGHT RHEOSTAT SWITCH (J, fig. 5).** A 5-position switch is used to turn the panel lights on or off. When the pointer is turned all the way counterclockwise, the lights are off. In any of the other 4 positions, the lights are on in different intensities.

(8) **ENGINE TEMPERATURE GAGE (K, fig. 5).** An engine temperature gage, calibrated from 135 to 240 degrees, is located on the right-hand side of the instrument panel. Under maximum power, when atmospheric temperature is above 70 degrees on a level hard surface, the temperature of the engine should not be greater than 90 degrees above atmospheric temperature.

(9) **SIREN PUSH BUTTON (L, fig. 5).** A push button located at the lower right-hand side of the temperature gage operates the siren.

(10) **FUEL LEVEL GAGE (M, fig. 5).** An electrically operated fuel level gage is provided on the instrument panel and indicates the level of the fuel in the tank.

(11) **IGNITION SWITCH (N, fig. 5).** A 2-position ignition switch is provided on the instrument panel. With this switch in the "ON" position, the ignition circuit for the engine is completed; in the "OFF" position, the ignition circuit is broken.

(12) **STARTER SWITCH (O, fig. 5).** The starter switch button at the lower right-hand corner of the instrument panel pushed in, completes the circuit through the starter switch solenoid, causing the starter to crank the engine.

(13) **SPEEDOMETER (P, fig. 5).** The speedometer is located at center of the instrument panel and is equipped with a trip mileage reset (Q, fig. 5).

(14) **OIL PRESSURE GAGE (S, fig. 5).** The oil pressure gage is located on the left side of the instrument panel. Oil pressure under normal conditions is between 20 and 25 pounds. If during operation the oil pressure suddenly drops off, immediately stop the engine. This

OPERATION AND CONTROLS

fault may be due to low oil level. If the oil pressure drops off slowly, it may be due to a change in the viscosity of the oil due to overheating. Check the engine temperature. If the oil pressure drops to, or fails to rise above 15 pounds when the oil viscosity and level is known to be correct, operate the engine at reduced speeds until engine can be replaced or other corrections made.

(15) **FIRE DETECTOR TEST BUTTON** (T, fig. 5). A push button located below the fire detector signal light (U, fig. 5) permits testing the fire detector system. When this button is pressed, the wire running from the signal light bulb to the thermal units is grounded, and the signal light should go on (battery master switch and ignition switch both must be on). If the light fails to go on when the test button is pressed, the fire detector system is defective and should be corrected.

(16) **FIRE DETECTOR SIGNAL**. A red signal light (U, fig. 5) is provided on the left side of the instrument panel. The fire detector signal consists of a 32-candlepower bulb located behind a red lens. A wire from this bulb runs back to the engine compartment where several thermal switches will cause it to be grounded in case of fire. The grounding of this wire completes the circuit through the bulb with the result that the red light goes on (battery master switch must be on), warning the operator of the fire (par. 15).

c. Controls.

(1) **SERVICE BRAKE FOOT PEDAL**. Two shoe hydraulic brakes are provided at each of the 6 wheels and are operated by the conventional foot pedal. The pressure applied to the pedal is amplified through a Hydrovac booster system. The pressure applied to the shoes, while much higher than that applied to the pedal, is, however, increased or decreased as the pedal pressure is increased or decreased, allowing smooth control for whatever kind of stop is desired.

(2) **HAND BRAKE LEVER**. The hand brake lever is horizontally mounted directly in front of the driver, behind the instrument panel (fig. 6). Always be sure the parking brake is released before moving the car.

(3) **SPARK CONTROL**. The spark control is entirely automatic and requires no attention by the operator of the vehicle.

(4) **FOOT THROTTLE**. A hydraulic operating foot throttle pedal is located on the floor in front of the driver's seat to the right of the brake pedal, convenient to the driver's right foot (fig. 6).

(5) **STEERING WHEEL**. The conventional automotive-type steering wheel (fig. 6) is used.

LIGHT ARMORED CAR M8

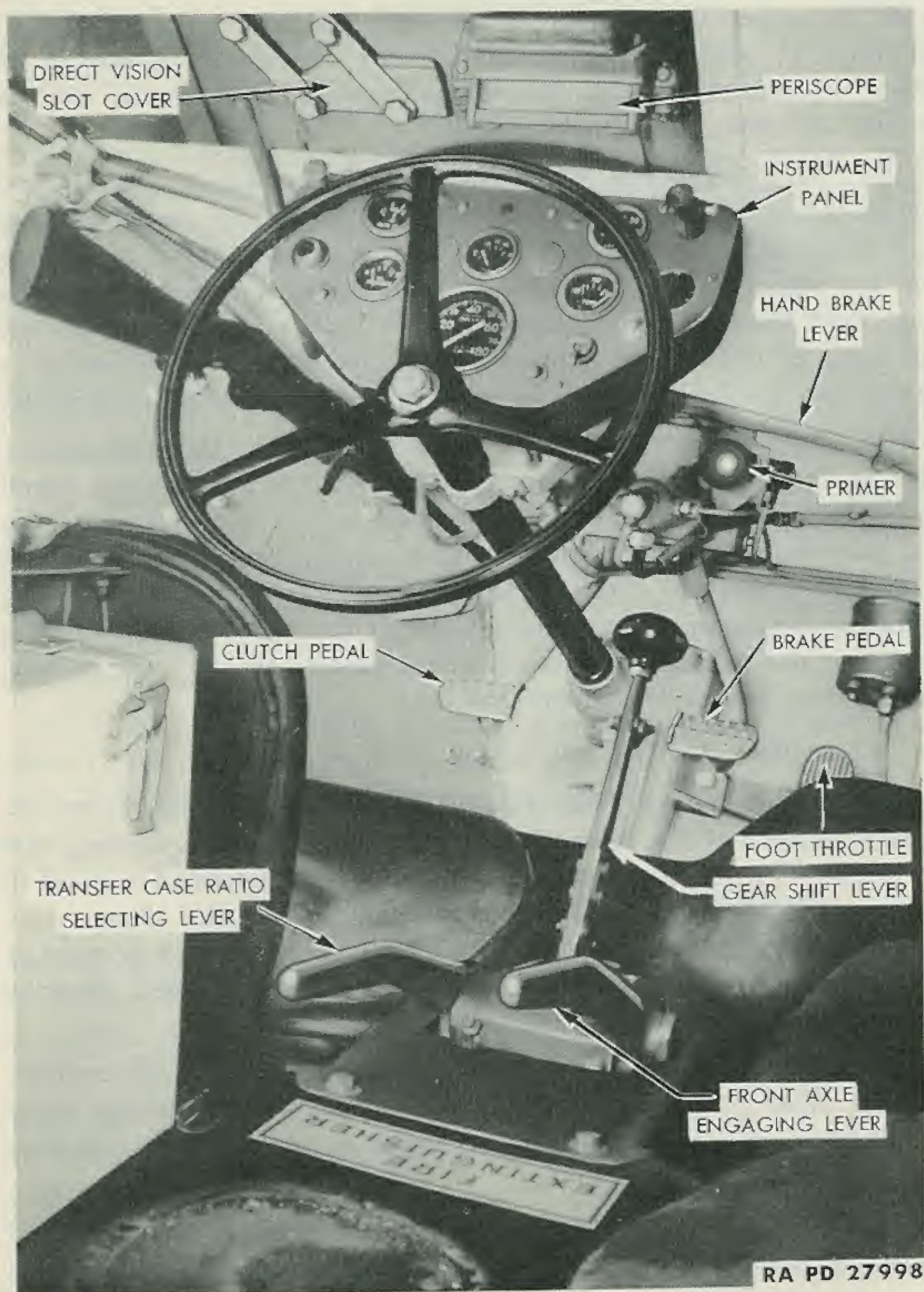


Figure 6 — Driver's Compartment

OPERATION AND CONTROLS

(6) **CLUTCH PEDAL.** The hydraulic operating clutch pedal is located on the floor in front of the driver's seat, convenient to the driver's left foot. The clutch is disengaged by depressing the clutch pedal which operates a master hydraulic cylinder. Pressure from the master cylinder operates a slave cylinder on the transmission to release the clutch.

(7) **GEARSHIFT LEVER** (fig. 7). The gearshift lever is located to the right of the driver. The crosswise movement of the lever selects the correct rail in the transmission shifter housing, and the fore and aft movement of the lever engages the correct gears.

(8) **FRONT AXLE ENGAGING LEVER** (fig. 8). The transfer case control lever farthest from the driver (fig. 8) engages the front axle in the "UP" position and disengages the front axle when in the "DOWN" position. The front axle must be engaged while the vehicle is moving slowly. In all instances, when shifting from high range to low range, reduce the speed of the vehicle to below 5 miles per hour before making the shift. The controls are interlocked so as to prevent engaging low gears of the transfer case until the front axle is engaged. Engage the front axle first before putting the transfer case in low ratio.

(9) **TRANSFER CASE GEAR RATIO SELECTING LEVER** (fig. 8). The transfer case control lever nearest the driver (fig. 8) selects the transfer case gear ratio. In the "DOWN" position, the transfer case is in high gear. In the "UP" position, the transfer case is in low gear. Engage the front axle before attempting to shift to low ratio.

(10) **PRIMER** (fig. 6). A priming pump to be used in subzero weather is located to the right of the brake master cylinder, convenient to the driver's right hand (fig. 6). To operate the primer, pull back the knob (this will fill the lines with fuel); then press in slowly as the engine is cranked. This causes a quantity of gasoline to be forced directly into the intake manifold for cold weather starting. Stop priming when the engine starts. Ordinarily, it will not be necessary to use the primer except during subzero weather. Excessive priming of the engine will cause flooding and failure to start, and the excess gasoline will wash the oil from the cylinder walls with the result that the cylinder will not be properly lubricated until the engine oil starts circulating.

(11) **BATTERY MASTER SWITCH** (fig. 9). A master battery switch is located in the fighting compartment in the upper right-hand corner (fig. 9). When the switch is off, the battery is completely disconnected and the entire electrical system is dead. Turn the battery master switch off when the vehicle is not in use to avoid discharging the battery.

LIGHT ARMORED CAR M8

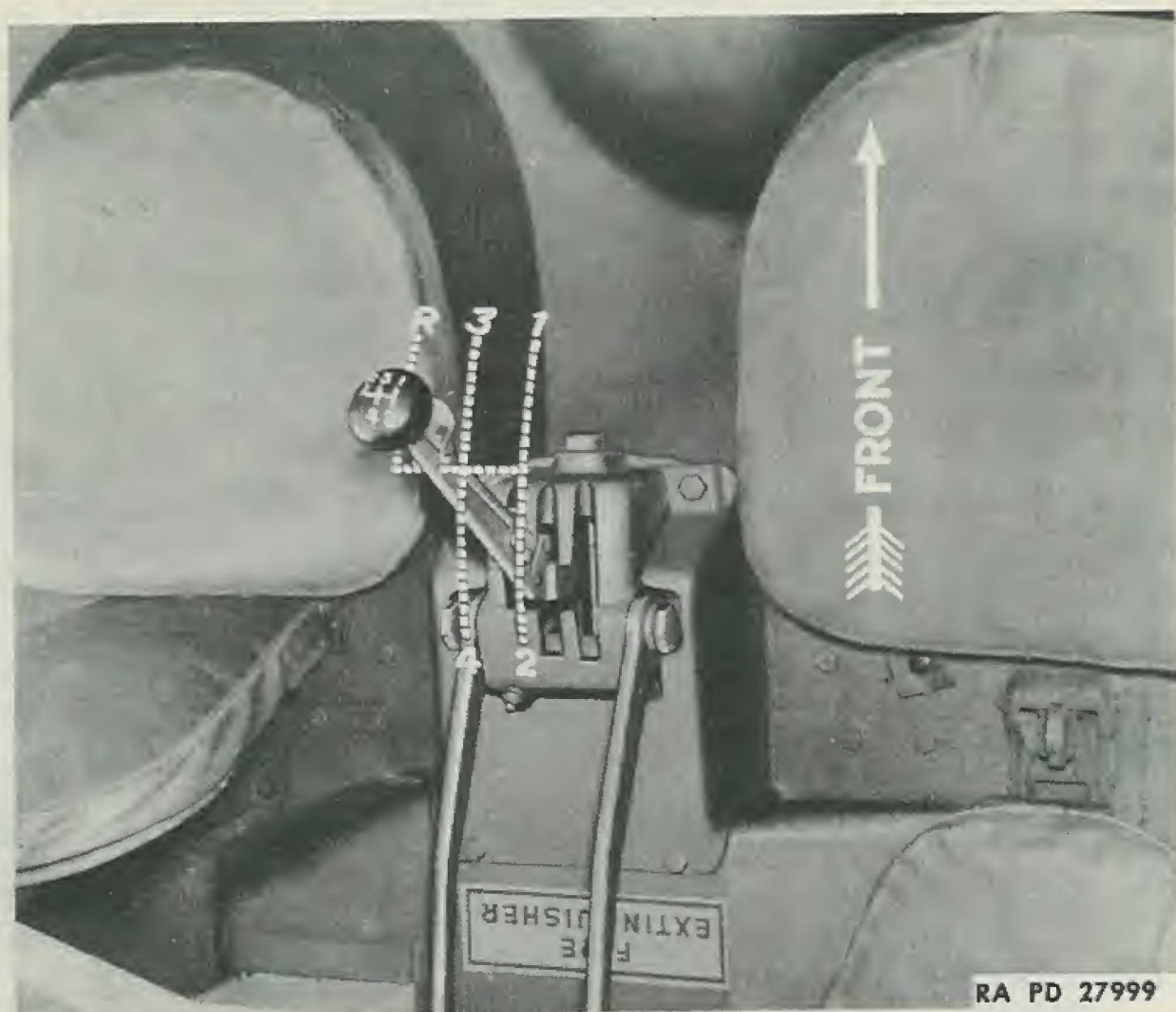


Figure 7 — Gearshift Lever Position

7. PRESTARTING INSPECTION.

a. **General Instructions.** The armored car has a crew of 4 men, and it is essential that all men be utilized in inspection of the vehicle under the direction of the car commander. The inspection should cover the vehicle as well as the engine.

b. **Inspection of Exterior of Vehicle.** Look at the ground under the armored car for oil and fuel leaks. Open fuel shutoff valve. Check that all pioneer tools are present. Check general condition of bogie, springs, shock absorbers, tie rod, drag link, wheels, and tires. Check radio antenna for breaks.

c. **Inspection in Engine Compartment.** Check for loose air tube connections from carburetors to air cleaners. Check engine oil level.

d. **Inspection in Fighting Compartment.** Check for presence and condition of fire extinguishers and vehicle tools. Check operation of turret and locking mechanism. Check traverse and elevation of vehicle's weapons. Check to see that ammunition, flags, field equipment, and rations, if carried, are properly loaded.

OPERATION AND CONTROLS

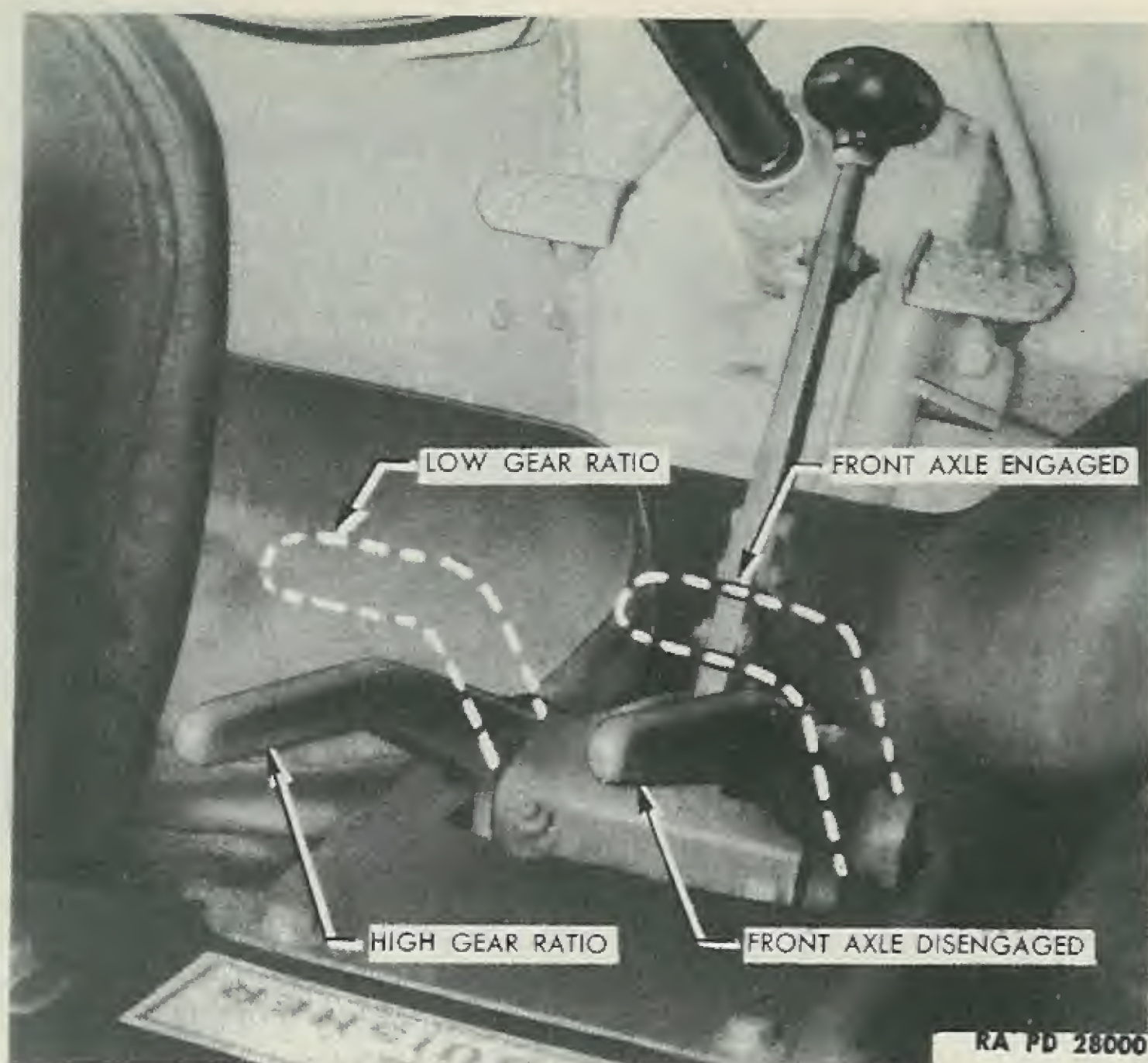


Figure 8 – Transfer Case Controls

e. **Inspection in Driver's Compartment.** Check instrument panel and see that instruments indicate normal shutoff readings. Check to see that clutch pedal and transmission transfer case shift levers operate freely and over their full range. Turn battery master switch on. If ammeter shows excessive discharge with all switches open, a short circuit exists and must be corrected immediately. Check fire detector signal (par. 6 a (15) and (16)). Check lights and siren. Check fuel level; fill, if necessary.

8. STARTING INSTRUCTIONS.

a. **Prestarting Instructions.** Before attempting to start the engine, familiarize yourself with all of the various instruments and controls (par. 6). Make sure that the function of each control is thoroughly understood and the significance of the readings on the various instruments is appreciated. Make prestarting inspection (par. 7).

LIGHT ARMORED CAR M8

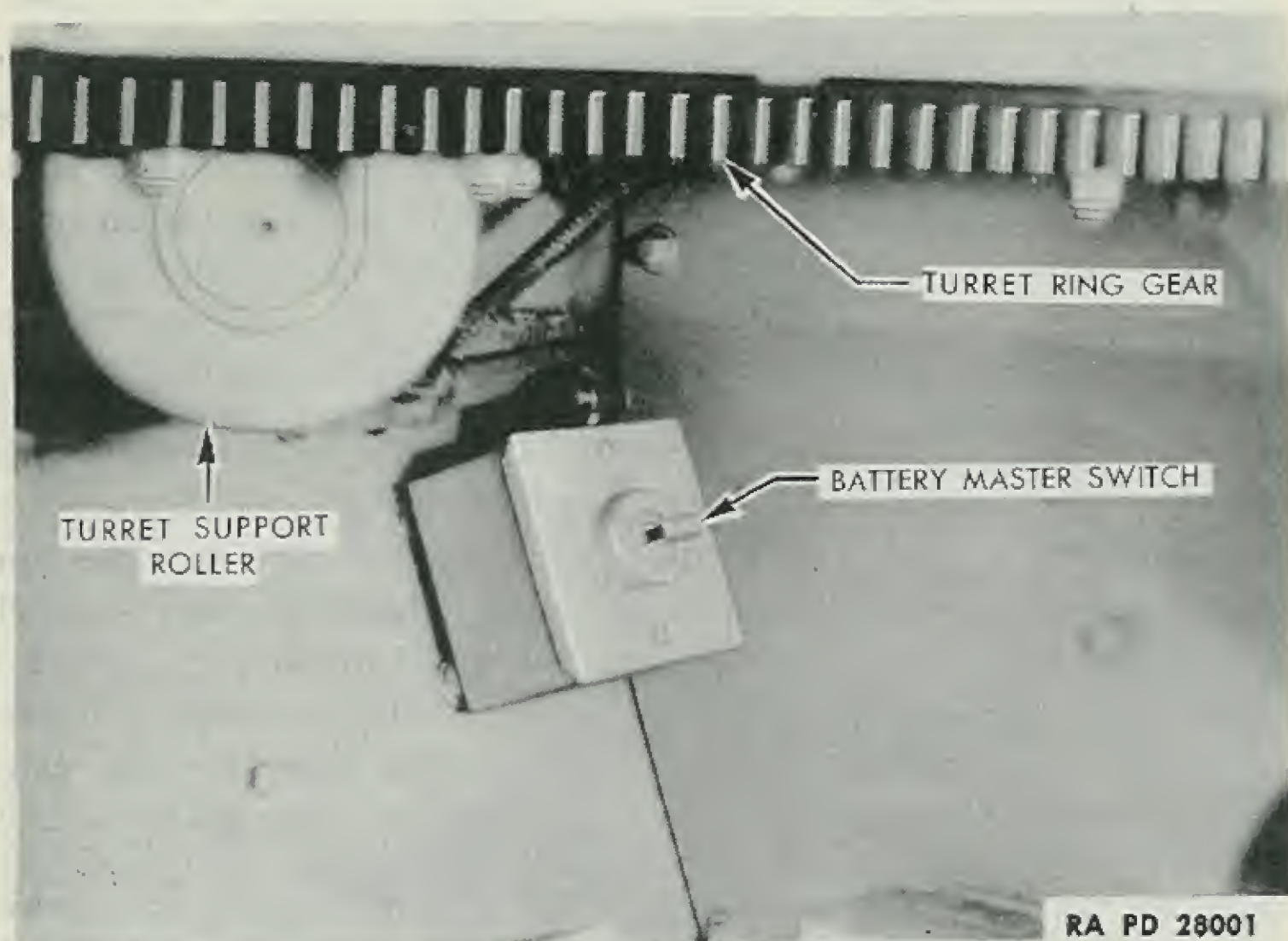


Figure 9 — Battery Master Switch

b. **Set Controls in Neutral.** Put gearshift lever in neutral (fig. 7). Make sure transfer case control lever (fig. 8) is in desired position.

c. **Warm Weather Starting.** Turn battery master switch (fig. 9) and the ignition switch to their "ON" positions. Depress the clutch pedal. Still holding the clutch pedal down, press the starter button. If the engine is hot, hold the throttle open while the engine is being cranked. If the engine is cold, the automatic choke will permit easy starting. Hold the clutch pedal down until the engine starts. When the engine starts, make engine test (par. 9). If the engine fails to start, refer to paragraph 47. **NOTE:** If the temperature is below zero F, use procedure outlined in subparagraph d, below.

d. **Cold Weather Starting.** When the temperature is below zero F, use the following procedure to start the engine. Turn battery master switch and the ignition switch to their "ON" positions. Prime the engine as outlined in paragraph 6 b (10). Hold the clutch pedal down and press the starter button until the engine starts. As the engine starts, 2 or 3 quick strokes of the foot throttle will assist in keeping the engine running. When the engine starts, make engine test (par. 9). If the engine fails to start, refer to paragraph 47.

OPERATION AND CONTROLS

9. ENGINE TEST.

a. As soon as the engine starts, check the oil pressure. Stop the engine if normal oil pressure is not indicated within 30 seconds. Check the operation of instruments and switches while the engine is idling. Idle engine until engine temperature gage reads above 135 degrees. Listen to the engine to note any unevenness or unusual sounds.

10. OPERATING THE VEHICLE.

a. **Preliminary Instructions.** Before attempting to drive the vehicle, the prospective driver should be thoroughly familiar with all the instruments and the significance of the readings. One must also know the function and operation of all of the controls in the driver's compartment. The limitations of the vehicle and engine are covered under paragraph 5 k. Review of paragraphs 6 through 9 will be helpful. If the foregoing instructions have been followed, with the engine at idling speed and all instruments showing normal readings, the driver may now operate the vehicle.

b. **Setting the Vehicle in Motion.** Be sure to release the parking brake (fig. 6). Disengage the clutch by pressing clutch pedal (fig. 6) down to the floor and holding it down. Move the gearshift lever into first gear (fig. 7). Gradually engage the clutch by reducing the pressure on the clutch pedal (fig. 6), at the same time depress the foot throttle (fig. 6). Except when under fire, do not move the vehicle in or out of close quarters without the aid of personnel outside of the vehicle serving as a guide.

c. **Changing to Second Gear.** When the vehicle has started and is moving at some speed below 4 miles per hour with transfer case in low ratio (fig. 8), release the foot throttle, depress the clutch again, and move the gearshift lever into the second gear position (fig. 7). Release the clutch pedal and again depress the throttle to pick up the load of the vehicle.

d. **Changing to High Gear.** Repeat the above procedure until the highest gear is reached which will enable the vehicle to proceed at the desired speed without causing the engine to labor. Do not lose sight of the fact that the engine is not governed and can be seriously damaged by high speeds in the lower gears. For maximum speeds permissible with each possible gear combination, refer to paragraph 5 k. Do not ride the clutch. The driver's left foot must be completely removed from the clutch pedal while driving to avoid unnecessary wear and burning out the clutch.

e. **Backing the Vehicle.** To place the vehicle in reverse gear, a complete stop must be made. After forward movement of the vehicle has

LIGHT ARMORED CAR M8

stopped, depress the clutch pedal and move the gearshift lever to the reverse position (fig. 7). Backing the vehicle should never be attempted unless an observer is stationed in front to guide the driver.

f. Negotiating Turns. It is better to go into a turn slowly, increasing the speed during the turn, rather than to enter the turn too fast and have to apply the brakes during the turn. The driver should anticipate each turn as much as possible.

g. Operation on Hard Pulls. Never lug engine at wide open throttle below one-third of the maximum speed allowable for whatever gear ratio is being used (par. 5 k). Shift to a lower gear.

h. Use of Gages on the Instrument Panel. The driver must be familiar with all of the gages and must note their readings frequently during operation of the vehicle. The temperature gage and the oil pressure gage give the most satisfactory indications of the performance of the engine. When the indications of these instruments appear to be irregular, stop the engine (par. 11) and determine the cause. Check oil pressure and temperature frequently.

i. Stopping the Vehicle. To stop the vehicle, remove the right foot from the foot throttle and apply the foot brakes. Depress the clutch pedal when the vehicle has slowed down to approximately 2 to 5 miles per hour, depending upon which gear is being employed before stopping. Allow the engine to idle for the duration of the halt if halt is not to be more than 5 minutes.

11. STOPPING THE ENGINE.

a. After completing a run, the engine must be allowed to operate at idling speed for 2 minutes to assure a gradual and uniform cooling of the valves and various other engine parts. Put the gearshift lever in neutral and turn the ignition switch to "OFF" position. Turn the battery master switch off if the vehicle is to be stopped for more than 5 minutes.

12. TOWING.

a. A towing shackle is mounted on each corner of the hull of the vehicle about 20 inches from the ground. Two of these shackles are mounted in front (fig. 2), and two in the rear (fig. 50). These shackles provide a quick method of attaching either the towing bar or cables. When the vehicle is being towed, shift the transfer case to neutral (fig. 8).

Section III

OPERATION UNDER UNUSUAL CONDITIONS

	Paragraph
Cold weather starting.....	13
Operation at high temperature.....	14
Operation at high altitudes.....	15
Operation in sand.....	16
Operation on slippery terrain.....	17
Operation under dusty conditions.....	18

13. COLD WEATHER STARTING.

a. When starting the engine in cold weather, it is important to follow the procedure outlined in paragraph 8 d. If this procedure is followed, little additional instructions are required. It will be noted that in this procedure several strokes with the foot throttle are recommended to keep the engine running. This causes the accelerating pump in the carburetor to assist the automatic choke in enriching the mixture in cold weather. Briefly stated, cold weather starting problems are always the result of poor preparation or maintenance of the vehicle, and, in addition to the cause of failure to start as outlined in paragraph 8, can be attributed to either the engine oil being too heavy for the temperatures encountered or the battery being low in charge.

14. OPERATION AT HIGH TEMPERATURE.

a. When starting a hot engine, hold the throttle open while the engine is being cranked. When operating at high temperatures, observe the engine temperature gage frequently and add water to the cooling system as often as may be required to prevent overheating. The viscosity of the various oils used decreases at higher temperature; be sure oils are being used with sufficient body to match the temperature. Engine oil thinned out by high temperature is used up more rapidly. Check the engine oil level frequently.

15. OPERATION AT HIGH ALTITUDES.

a. High altitudes result in a lowering of compression due to lowered atmospheric pressure and a corresponding lowering of the developed horsepower. Due to rarefied atmosphere a smaller quantity of air is taken into each cylinder while the quantity of fuel remains practically the same as at sea level. This results in the fuel air mixture being too rich. This can only be remedied by reducing the size of the

LIGHT ARMORED CAR M8

various carburetor jets if the vehicle is to be operated continually at high altitudes. Generally speaking, elevations up to 5,000 feet present no particular problems and can be considered as normal.

16. OPERATION IN SAND.

a. Desert operation and operations under extremely sandy road conditions may necessitate cleaning the air cleaner as often as every 2 hours. When operating in sand deep enough to force the use of lower gear ratios, do not exceed the speed specified for the particular gear ratio (par. 5 k).

17. OPERATION ON SLIPPERY TERRAIN.

a. For operating the vehicle in mountainous terrain, in mud, or over ice and snow, when sufficient traction is not normally possible, chains are provided for all of the wheels of the vehicle. Chains, however, do not always prevent sidewise skids, and it is important that the vehicle be operated at reasonable speeds on slippery surfaces. Even at reasonable speed, side skids are possible and the best means of recovery is to turn the front wheels in the direction of the skid. This forces the front wheels to turn instead of to slide sidewise.

18. OPERATION UNDER DUSTY CONDITIONS.

a. In operating the vehicle cross-country on dry, dusty ground along with other vehicles, avoid running in the dust cloud of other vehicles as much as possible. When operating in single file on dusty roads where no cross wind exists, space the vehicles far enough apart to reduce the dust hazard as much as possible if practicable. Even when the above precautions are taken, it may be necessary to clean the carburetor air cleaner and the air cleaner on the oil filler pipe (par. 57) as often as every 2 hours (par. 69). If the air cleaners are kept clean and their oil level is maintained, little damage to the engine will result. On the other hand, if the air cleaners run dry, it is possible to wear out an engine in 1 hour or less.

Section IV

ARMAMENT

	Paragraph
Combination gun mount.....	19
Unmounted guns	20
Ammunition stowage	21

19. COMBINATION GUN MOUNT.

a. Description. The Combination Gun Mount M23A1 is located in the turret, and mounts a 37-mm Gun M6, and a Browning Machine Gun, cal. .30, M1919A4, flexible, which move together as a single unit. The gunner sits in the left forward side of the turret to the left of the gun mount, while the loader sits on the right.

b. The 37-mm Gun (fig. 10).

(1) **ELEVATION.** Elevation or depression of the gun is secured by a handwheel located on the left side of the gun mount, convenient to the gunner's right hand. Turning the elevating wheel counterclockwise depresses the gun a maximum of 10 degrees, while turning it clockwise elevates it to a maximum of 20 degrees.

(2) **TRAVERSE (fig. 10).** Traverse of 360 degrees is secured by rotating the entire turret by the handwheel (fig. 10). The turret can be locked in any position by means of the turret lock.

(3) **FIRING (fig. 10).** The foot firing control consists of a button located convenient to the gunner's left foot, directly beneath the gun (fig. 10).

c. Cal. .30 Machine Gun (fig. 10).

(1) **DESCRIPTION.** The cal. .30 gun is located in its combination gun mount as outlined in paragraph 19 a. This gun can be pulled from its mounting and used on a tripod which is stowed in the right rear fender box.

(2) **FIRING (fig. 10).** The cal. .30 gun is fired by a button located convenient to the gunner's right foot (fig. 10) or can be fired by the trigger on the gun itself located in front of the pistol grip.

20. UNMOUNTED GUNS.

a. Description. Four cal. .30 carbines are carried in the vehicle, 2 in clips in the turret and 2 strapped to the wall in the driver's compartment.

LIGHT ARMORED CAR M8

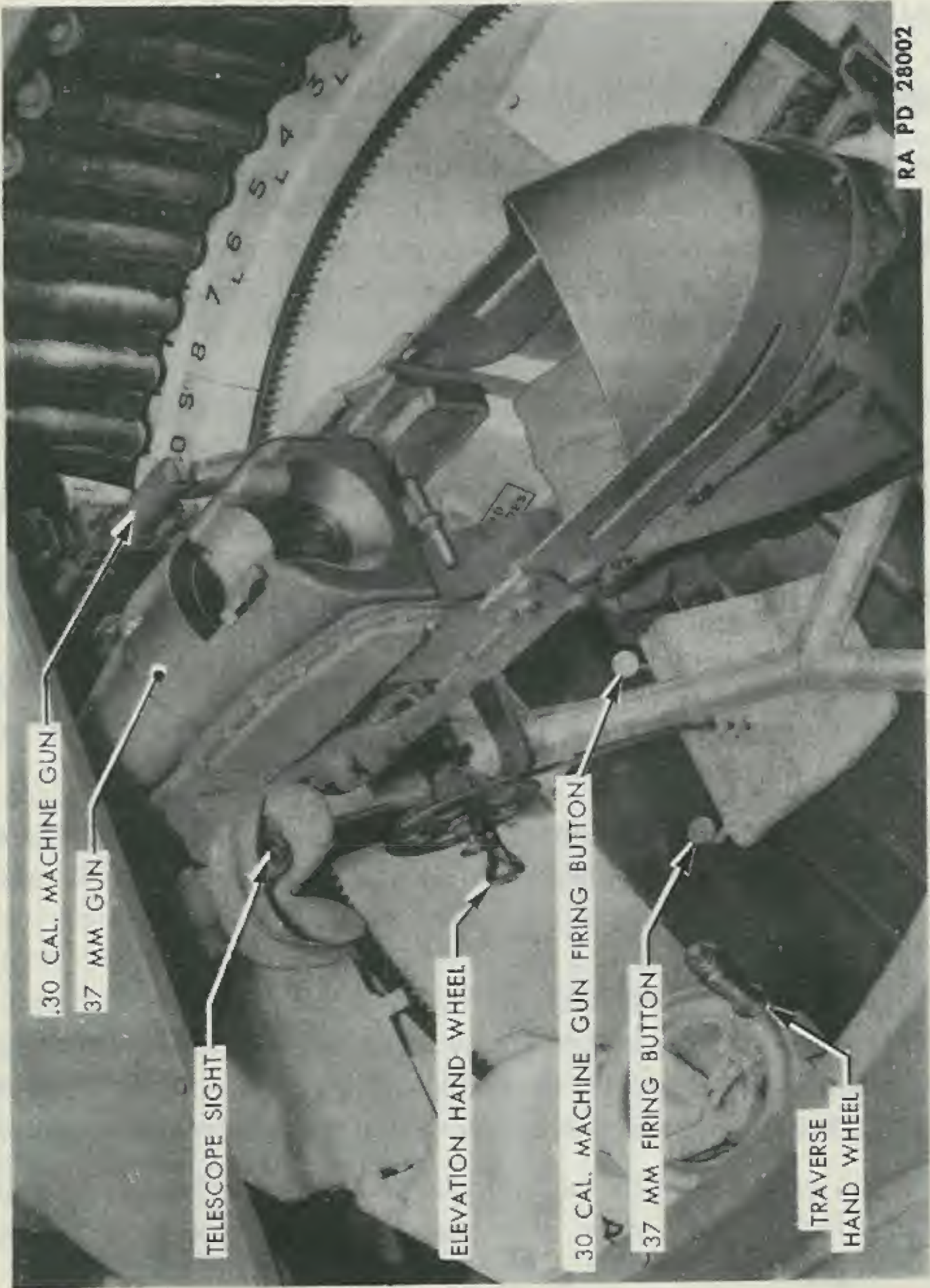


Figure 10 — Gunner's Controls

ARMAMENT

21. AMMUNITION STOWAGE.

a. Ammunition used in the guns of the Light Armored Car M8 is stowed in the vehicle as listed below:

Ammunition	Stowage Position
80 rounds, 37-mm	16 rounds in clips, in turret
	64 rounds in racks, in upper right sponson
400 rounds, cal. .30 (Carbine M1)	In M1 Ammunition Box, in lower sponson
1,500 rounds, cal. .30 (machine gun)	In lower left sponson
80 rounds, 37-mm	16 rounds in clips, in turret
	64 rounds in rack, in upper right sponson
16 hand grenades:	In 4 boxes in fighting compartment
6 fragmentation	
6 offensive	
4 smoke, WP	
4 POT, smoke, M1 or M2	In lower right sponson
6 MINE, antitank, H.E., M1, with FUZE, M1	3 on outside of each sponson

LIGHT ARMORED CAR M8

Section V

PREVENTIVE MAINTENANCE AND INSPECTIONS

	Paragraph
Purpose	22
Prestarting inspection	23
Inspection during operation.....	24
Inspection at the halt.....	25
Inspection after operation.....	26
Periodic inspections	27

22. PURPOSE.

a. **Preventive Maintenance.** To insure mechanical efficiency, it is necessary that the armored car systematically receive preventive maintenance service and inspections at intervals, in order that defects may be discovered and corrected before they result in serious damage.

b. **Cracks.** Cracks that develop in castings or other metal parts may often be detected through the medium of dust and oil deposits upon completion of the run.

c. **Suggestions.** Suggestions toward changes in design prompted by chronic failure or malfunction of a unit or group of units, pertinent changes in inspection or maintenance methods, and changes involving safety, efficiency, and economy should be forwarded to the Office of the Chief of Ordnance, through proper channels, at the time they develop. Such action is encouraged in order that organizations may profit thereby.

23. PRESTARTING INSPECTION.

a. Before the engine is started, follow the procedure outlined in paragraph 7.

24. INSPECTION DURING OPERATION.

a. **Indications of Trouble.** During operation the driver will be on the alert to detect abnormal functioning of the engine. He should be trained to detect unusual engine sounds or noises. He should glance frequently at the instrument panel gages to see if the engine is functioning properly (par. 10 h). An unsteady oil gage needle indicates low oil level, provided that engine speed is fairly constant. The operation of the steering mechanism must be noted during operation to detect faults and permit their correction before serious troubles develop.

PREVENTIVE MAINTENANCE AND INSPECTIONS

b. **Test for Cylinders Missing.** During operation of the vehicle (just before operation is completed), make the following test with the car traveling in high gear at approximately 5 miles per hour: Apply the brake gradually, at the same time opening the throttle, so as to maintain the speed of 5 miles per hour. This will cause the engine to labor and each impulse of the engine can be felt. This will reveal any missing cylinders. This test should require only a few seconds to perform, otherwise the brakes will overheat.

c. **When Trouble Develops.** Only under exceptional circumstances will an armored car be operated after indications of trouble have been observed. When in doubt, the engine will be stopped, and assistance obtained. Inspection during operation applies to the entire vehicle and must be emphasized throughout the driving instruction period.

25. INSPECTION AT THE HALT.

a. **General Instructions.** At the halt the operator will make a careful inspection of the armored car to determine its general mechanical condition. Minor defects detected during the march, together with defects discovered at the halt, will be corrected before resuming the march. If the defects cannot be corrected during the halt, proper disposition of the vehicle will be made so that unnecessary delay may be avoided and a major failure prevented.

b. **Inspection in Driver's Compartment.** If inspection during operation (par. 24 b) reveals one or more cylinders missing, notify ordnance maintenance personnel. Inspect the lights, if traveling at night with lights. Check the amount of fuel in the tank.

c. **Inspection of Exterior of Vehicle.** Clean all vision devices. Do not use an oily or dirty cloth. Walk around the vehicle, looking carefully for fuel or oil leaks. Be sure to drain out any oil that has leaked onto the hull floor, after correcting the cause of the leakage. Examine the wheels, tires, steering linkage, front axle, and bogie for adjustment and for worn, loose, broken, or missing parts. Inspect hull and fittings for missing, worn, or loose parts.

26. INSPECTION AFTER OPERATION.

a. **General Instructions.** At the conclusion of each day's operation, the armored car commander should cause an inspection to be made, similar to that made at halts, but more thorough and detailed. The inspection should be followed by preventive maintenance. If defects cannot be corrected, they should be reported promptly to the chief of section or other designated individual. The following points should be covered:

LIGHT ARMORED CAR M8

b. **Inspection in Driver's Compartment.** Inspect lights and siren. Check for loose or damaged accessories. Inspect vision devices for breakage. Inspect all control linkage to locate loose or broken parts.

c. **Inspection in Fighting Compartment.** Replenish ammunition. Inspect the sighting devices for breakage. Inspect guns and mounts for defective performance. Inspect guns, sighting equipment, and accessories, and determine that covers are properly installed. Inspect ammunition and fighting compartment for cleanliness and orderly arrangement.

d. **Inspection in Engine Compartment.** Check, clean, and refill air cleaner with clean oil during extremely dusty operations. Clean crankcase breather and replenish oil. Inspect all control linkage to locate loose or broken parts. Inspect electrical wiring for loose connections. Replenish engine oil. For continuous operation in hot weather, battery water must be replenished about twice a week. Check and clean battery and compartment weekly.

e. **Inspection of Exterior of Vehicle.** Examine wheels, tires, steering linkage, front axle, and bogie. Install gun covers. Clean all floors. Replenish fuel. Always touch the nozzle of the gasoline hose to the hull of the armored car before removing gas tank cap to eliminate possibility of a static charge of electricity in either the car or the gasoline truck from causing an explosion and fire when cap is removed from gas tanks.

27. PERIODIC INSPECTIONS.**a. After 500 Miles of Operation.**

(1) **GENERAL INSTRUCTIONS.** This check is made without removing the engine from the vehicle. Lubricate the vehicle throughout in compliance with lubrication instructions. Check for leaks, etc. will be made with engine compartment open and engine running. When all of the steps of this procedure have been completed, the vehicle must be road tested. Make routine after operation inspection (par. 26) and the following:

(2) **INSPECTION IN DRIVER'S COMPARTMENT.** Check engine for unusual operating noise or smoke. Check and adjust all control linkage for wear, free operation, and missing cotter pins. See that full travel of controls is obtained. This applies to all controls of the vehicle.

(3) **INSPECTION IN ENGINE COMPARTMENT.** Inspection for oil leaks at oil pan. Change engine oil. Inspect fuel pumps and, if leaking, tighten or replace pump. Check fuel and oil lines for breaks, loose connections and chafing. Check level of fuel in carburetor float bowl. Make external inspection of rigid and flexible lines having sharp bends or kinks. Service air cleaner; do not overfill with oil. Check all air induction pipes and

PREVENTIVE MAINTENANCE AND INSPECTIONS

connections for leaks. Check carburetor flange gasket. Service batteries. Tighten engine rear mounting bolts. Check all flexible conduits for breaks and worn sections.

(4) **INSPECTION FROM EXTERIOR OF VEHICLE.** Close fuel line valve; remove the bolt passing through the fuel filter; and remove and clean the bowl and filter element (par. 69 c). If excessive water or dirt is observed, drain and clean fuel tank. Check bogie, shock absorbers, springs, all axles, steering mechanism, steering linkage, cotter pins, and lockwires for tightness, or broken and missing parts. Check all propeller shaft flange nuts for tightness. Check transfer case oil level. Check all accessories for security and operation. Check oil level in transmission. Tighten engine forward mounting bolts. Inspect engine oil pan for leaks.

b. After 5,000 Miles of Operation.

(1) **GENERAL INSTRUCTIONS.** Check, and, when necessary, replace or exchange units such as engines, axles, etc. or unit accessories such as headlights, batteries, sirens, generators, wiring harness, etc. This inspection includes the removal of the engine for inspection, even though the engine appears to be performing normally. The daily and 500-mile inspection will be repeated in addition to the following operations and inspections. When all of these operations have been performed, the vehicle must be road tested.

(2) **INSPECTION WITH ENGINE REMOVED.** Remove engine (par. 49); place on inspection stand and clean with SOLVENT, dry-cleaning. Remove transmission and disassemble the clutch (par. 119 b); inspect plates; lubricate clutch hub, spindle, throwout and pilot bearings. Check clutch throwout bearing for wear and flat spots on races. Check flywheel mounting bolt nuts for tightness and presence of cotter pins. Check valve spacing. Check engine manifold gaskets and secure nuts for tightness. Inspect starter, generator, brushes, commutator, and general internal appearance. If brushes need replacing or if other repairs are indicated, replace starter or generator. Inspect distributor breaker and reset points to 0.020 inch, using feeler gage. Check points for pitting. If points show ash-colored burning, have condensers checked. Install the engine in the hull. Before installing the radiator, clean all dust from air passages, drain and flush out inside. Remove flushing material completely.

(3) **INSPECTION AFTER ENGINE IS INSTALLED.** Time ignition; inspect carburetor for float bowl fuel level. Install new spark plugs if required. Check both new and old plugs before installing them. NOTE: Do not change spark plugs until all other top cylinder work has been completed. Check for exhaust leaks. Check all exhaust pipes for cracks, burned out spots, and rust. Check carburetor air horn rubber connections for

LIGHT ARMORED CAR M8

restricted passages. Adjust clutch (par. 118). Check all nuts securing engine accessories, fan and shroud, support brackets, etc. for tightness. Clean magnetic plugs in engine oil pans, transmissions, and transfer case, and check magnetic ability. Refill engine oil pan, transmission and transfer case. Adjust service brakes (par. 159). Check all hydraulic lines and fittings and replenish hydraulic fluid. Check operation of the foot accelerator. Lubricate vehicle throughout, in compliance with lubrication instructions. Road test.

Section VI

LUBRICATION

Paragraph 28 }
29 } These paragraphs, together with figures 11 and 12,
30 } were not available for incorporation in this manual at
31 } the time of printing.

LIGHT ARMORED CAR M8

Section VII

GENERAL CARE AND PRESERVATION

	Paragraph
Records	32
Cleaning	33

32. RECORDS.

a. **Use.** An accurate record must be kept of each motor vehicle issued by the Ordnance Department. For this purpose the Motor Book for Ordnance Vehicles (O.O. Form 7255), generally called "Log Book," is issued with each vehicle and must accompany it at all times. This book furnishes a complete record of the vehicle from which valuable information concerning operation and maintenance costs, etc. is obtained, and organization commanders must insist that correct entries be made. This book will habitually be kept in a canvas cover to prevent its being injured or soiled.

b. **Assignment Record.** The page bearing a record of assignment must be destroyed prior to entering the combat zone. All other references which may be posted regarding the identity of the organization must also be deleted.

33. CLEANING.

a. **Cleaning.** Grit, dirt, and mud are the sources of greatest wear to a vehicle. If deposits of dirt and grit are allowed to accumulate, particles will soon find their way into bearing surfaces, causing unnecessary wear, and, if the condition is not remedied, will soon cause serious difficulty. When removing engine parts or any other units, in making repairs and replacements, or, if in the course of inspection, working joints or bearing surfaces are to be exposed, all dirt and grit that find its way to the exposed surfaces must first be carefully removed. The tools must be clean, and care must always be taken to eliminate the possibilities of brushing dirt or grit into the opening with the sleeve or other part of the clothing. To cut oil-soaked dirt and grit, hardened grit, or road oil, use SOLVENT, dry-cleaning, applied with cloths (not waste) or a brush. Care should be taken to keep water from the power unit, as it might interfere with proper ignition and carburetion. Detailed information on cleaning is included in TM 9-850.

b. **Oilholes.** Oilholes which have become clogged should be opened with a piece of wire. Wood should never be used for this purpose, as splinters are likely to break off and permanently clog the passages.

GENERAL CARE AND PRESERVATION

c. **Vehicles Caught in Gas Attack.** Particular care should be taken to clean and decontaminate vehicles that have been caught in a gas attack. See section IX on "Materiel Affected by Chemicals" for details of this operation.

LIGHT ARMORED CAR M8

Section VIII

EQUIPMENT AND TOOLS ON VEHICLE

	Paragraph
Equipment and location.....	34
Care of equipment.....	35

34. EQUIPMENT AND LOCATION.

a. **Equipment.** The items listed below are carried with each vehicle and are either strapped in place on the exterior of the vehicle or located in fender boxes or inside of the hull.

(1) ACCESSORIES AND EQUIPMENT, MISCELLANEOUS.

Equipment	Stowage Position
APPARATUS, decontaminating, 1½-qt (2)	1 in each rear fender box
BAG, canvas field, O.D., M1936 (4)	2 in each rear fender box
BUCKET, water, canvas, 18-qt	In left rear fender box
CABLE, towing	On hull exterior
CAN, ¼-gal, engine oil (2)	In engine compartment
CANTEEN, M1910, with cup and cover (4)	2 at side (left) of turret, 1 each beside driver and assistant driver
CHAIN, tire (6)	Left front fender box
CHEK-CHART, lubrication	Map clips by assistant driver
CONTAINER, water, 5-gal, A353	Behind driver's seat
COVER, turret opening, canvas	Right front fender box
EXTINGUISHER, fire, 4-lb, CO	Behind driver's seat
FLASHLIGHT (4)	1 near each member of crew, 2 in turret, 2 in driving com- partment
SHEET, instruction (Pioneer compass)	
KIT, first-aid (24-unit)	Under side of turret support plate ahead of gunner
MACHETE, M1939 (with sheath) (2)	Right front fender box
MANUAL, field, cal. .30, Carbine M1 (FM 23-7)	In envelope in left rear fender box

EQUIPMENT AND TOOLS ON VEHICLE

Equipment	Stowage Position
MANUAL, field, cal. .30, Machine Gun M1919A4 (FM 23-50)	In envelope in left rear fender box
MANUAL, field, for hand grenades (FM 23-30)	In envelope in left rear fender box
MANUAL, field, 37-mm Gun M6 (FM 23-81)	In envelope in left rear fender box
MANUAL, spare parts (for vehicle)	In envelope in left rear fender box
MANUAL, technical (for Light Armored Car M8)	In map clips by assistant driver
MANUAL, training (for engine)	In envelope in left rear fender box
MITTEN, asbestos, pair (medium)	In right front fender box
OUTFIT, cooking, gasoline	In right front fender box
PAULIN, 12- x 12-ft	On outside of turret at rear
ROLL, blanket (4)	On outside of turret, 2 at rear and 1 on each side toward front
ROLL, tool (without contents)	In right front fender box
ROLL, tape, adhesive, 4-in. wide, 15-yd long (blue) (spec. 16121)	In tool roll
ROLL, tape, friction, 3/4-in. wide, 30-ft long	In tool roll
TUBE, flexible nozzle	In right front fender box
WIRE, soft iron, 14-gage, 10-ft	In tool roll
(2) TOOLS (PIONEER).	
AXE, chopping, single-bitted, 5-lb	Hull exterior on top of left sponson
HANDLE, mattock (TFHX1A)	Hull exterior on top of right sponson
MATTOCK, pick, M1 (without handle) (B191907A)	Hull exterior on top of right sponson
SHOVEL, short handle	Hull exterior on top of left sponson
(3) TOOLS (VEHICULAR).	
ADAPTER (button-head to hydraulic type fitting) (CLCX1H)	On hose (CLCX1A)

LIGHT ARMORED CAR M8

Equipment	Stowage Position
CHISEL, cold, $\frac{5}{8}$ -in. (TBAX1B)	In tool roll in right front fender box
FILE, 3-sq, smooth, 6-in. (TEAX2CP)	In tool roll in right front fender box
FILE, hand, smooth, 8-in. (TEAX1DF)	In tool roll in right front fender box
GAGE, tire pressure	In tool roll in right front fender box
GUN, grease, hand, type 1 (CLAX5A)	In right front fender box
HAMMER, machinist ball peen, 3202 (TAXX1D)	In tool roll
HANDLE, flexible, 1½-in. square drive, 12-in. long (with cross bar) (TKEX2R)	In tool roll
HANDLE, wheel-wrench	In right front fender box
HOSE, gun, lubricating, pressure (CLCX1A)	In right front fender box
JACK, hydraulic, 5-ton (with handle)	In right front fender box
WRENCH, socket, ½-in. square drive, ¾-in., hexagonal (TKEX3H)	In tool roll
WRENCH, socket, ½-in. square drive, 7/8-in., hexagonal (TKEX3M)	In tool roll
WRENCH, socket, ½-in. square drive, 1⅝-in., hexagonal (TKEX3N)	In tool roll
WRENCH, socket, ½-in. square drive (for spark plug)	In tool roll
WRENCH, adjustable, single-end, 8-in. (TKAX3A)	In tool roll
WRENCH, engineer, double-head, alloy steel, $\frac{5}{16}$ - x $\frac{3}{8}$ -in. (TKKX1A)	In tool roll
WRENCH, engineer, double-head, alloy steel, $\frac{7}{16}$ - x ½-in. (TKKX1G)	In tool roll
WRENCH, engineer, double-head, alloy steel, $\frac{9}{16}$ - x 1⅛-in. (TKKX13F)	In tool roll

EQUIPMENT AND TOOLS ON VEHICLE

Equipment	Stowage Position
WRENCH, engineer, double-head, alloy steel, $\frac{5}{8}$ -x $\frac{3}{4}$ -in. (TKKX2F)	In tool roll
WRENCH, engineer, double-head, alloy steel, $\frac{1}{2}$ -x $\frac{7}{8}$ -in. (TKKX3D)	In tool roll
WRENCH, engineer, double-head, alloy steel, $\frac{1}{2}$ -x 1-in. (TKKX4C)	In tool roll
HANDLE, speeder, $\frac{1}{2}$ -in. square drive, 17-in. long (TKEX2L)	In tool roll
WRENCH, wheel nut	In tool roll
OILER, trigger-type, 1-pt	Engine compartment left side
PLIERS, combination, slip joint, 8-in. (THCX1A)	In tool roll
PLIERS, side cutting, parallel jaw, 8-in. (THAX1A)	In tool roll
RATCHET, reversible, $\frac{1}{2}$ -in. square drive, 9-in. (TKEX2B)	In tool roll
SCREWDRIVER (nonmagnetic, for Pioneer compass)	On compass bracket
SCREWDRIVER, common, 3-in. blade	In tool roll
SCREWDRIVER, machinist, 5-in. blade (TGBX1A)	In tool roll
SCREWDRIVER, special purpose, $1\frac{3}{4}$ -in. blade (TGAX2B)	In tool roll
WRENCH, socket, $\frac{1}{2}$ -in. square drive, $\frac{9}{16}$ -in., hexagonal (TKEX3D)	In tool roll
WRENCH, socket, $\frac{1}{2}$ -in. square drive, $\frac{5}{8}$ -in., hexagonal (TKEX3F)	In tool roll

(4) TOOLS, CAL. .30 MACHINE GUN.

SCREWDRIVER, common, 3-in. blade (TGAX1A)	Cal. .30 spare parts box, turret basket
WRENCH, combination, M6	Cal. .30 spare parts box, turret basket
WRENCH, socket, front barrel bearing plug	Cal. .30 spare parts box, turret basket

LIGHT ARMORED CAR M8

Equipment	Stowage Position
(5) RATIONS.	
BOX, type K (4 men for 2 days) (24)	In ration compartment of right sponson
CAN, type D (4 men for 1 day)	In ration compartment of right sponson
(6) SIGNALING EQUIPMENT.	
ANTENNA, complete with cover (per radio set) (spare)	On hull top forward of turret
FLAG, set, M238, composed of:	On right side of fighting compartment on ration box cover
CASE, CS-90	
FLAG, MC-273 (red)	
FLAG, MC-274 (orange)	
FLAG, MC-275 (green)	
STAFF, MC-270 (3)	
FLARE, signal (for projector, signals, ground, M4) (15)	In M1 Ammunition Boxes in left lower sponson
PANEL, AP50 (12-ft x 2-ft x 4-in., fluorescent neon red on one side, fluorescent white on the other side)	Left rear fender box
PROJECTOR, signals, ground, M4	On right side wall of fighting compartment
RADIO, set, SCR 506 (command car, cavalry, or armored force)	In right sponson (in place of 37-mm ammunition)
RADIO, set, SCR 508 (armored force only)	In left sponson
RADIO, set, SCR 510 (armored force and cavalry)	In left sponson
RADIO, set, SCR 608 (tank destroyer only)	In left sponson
RADIO, set, SCR 610 (optional to SCR 608)	In left sponson
(7) SIGHTING EQUIPMENT.	
BINOCULAR, M3, complete, consisting of:	
BINOCULAR, M3	
CASE, carrying	
STRAP, neck	

EQUIPMENT AND TOOLS ON VEHICLE

Equipment	Stowage Position
PRISM, protectoscope (spare) (6)	In 2 boxes at assistant driver's feet
PROTECTOR, vision (spare) (4)	2 in each spare protectoscope box
TELESCOPE, M54	In combination gun mount in turret
(8) ACCESSORIES (ARMAMENT).	
(a) Cal. .30 Machine Gun.	
BAG, empty cartridge (on M23A1 Mount)	On gun mount
BRUSH, chamber cleaning, M6	Cal. .30 spare parts box, turret basket
BRUSH, cleaning, cal. .30, M2 (6)	
CASE, tubular (without contents)	Cal. .30 spare parts box, turret basket
CASE, cleaning rod (2)	Cal. .30 spare parts box, turret basket
CASE, cover group	Cal. .30 spare parts box, turret basket
COVER, Tripod Mount M2	On tripod head
CASE, spare bolt, M2 (without contents) (3)	Cal. .30 spare parts box, turret basket
COVER, spare barrel	On barrel
ENVELOPE, spare parts, M1 (without contents)	Cal. .30 spare parts box, turret basket
EXTRACTOR, ruptured cartridge, MK.1V	Cal. .30 spare parts box, turret basket
MOUNT, tripod, machine gun, M2	Right rear fender box
OILER, rectangular, 12-oz	Cal. .30 spare parts box, turret basket
REFLECTOR, barrel, cal. .30	Cal. .30 spare parts box, turret basket
ROD, cleaning, jointed, cal. .30, M1	Cal. .30 spare parts box, turret basket
ROLL, spare parts, M13 (without contents)	Cal. .30 spare parts box, turret basket
ROLL, tool, M12 (without contents)	Cal. .30 spare parts box, turret basket

LIGHT ARMORED CAR M8

Equipment	Stowage Position
(b) 37-mm Gun.	
BAG, empty cartridge (on M23 Mount)	On gun mount
BOOK, Artillery Gun (0.0. Form 5825)	Map clips above assistant driver
BRUSH, bore, M8	37-mm spare parts box, behind driver
CAN, 1/4-gal, oil recoil	Fighting compartment at left rear corner
COVER, breech	On 37-mm gun mount
COVER, muzzle, 37-mm	On 37-mm gun mount
EXTENSION, oil gun	37-mm spare parts box, behind driver
GUN, oil recoil	37-mm spare parts box, behind driver
OIL, recoil, heavy, 1-qt	Fighting compartment at left rear corner
PIN, retaining	37-mm spare parts box, behind driver
ROLL, spare parts, M13	37-mm spare parts box, behind driver
SIGHT, bore	37-mm spare parts box, behind driver
STAFF, cleaning, M5A1	Hull top ahead of turret
TARGET, testing (set of 4)	37-mm spare parts box, behind driver

35. CARE OF EQUIPMENT.

a. An accurate record of all tools and accessories should be kept in order that their location and condition may be known at all times. Items becoming lost or unserviceable should be immediately replaced. All tools and equipment should be cleaned and in proper position for further use before being returned to their location. Care must be used in fastening the tools carried on the outside of the tank, and frequent inspection and oiling is necessary to prevent corrosion.

Section IX

MATERIEL AFFECTED BY CHEMICALS

	Paragraph
General	36
Protective measures.....	37
Decontamination	38
Special precautions for automotive materiel.....	39

36. GENERAL.

a. Gas clouds, chemical shell, and chemical spray are the major chemical warfare methods for destroying or damaging materiel. Removing or destroying the dangerous liquid or solid chemical agents spread by these methods, or changing these chemical agents to harmless substances is called decontamination.

37. PROTECTIVE MEASURES.

a. When materiel (except ammunition) is in constant danger of attack with chemicals, apply a light coat of engine oil to unpainted metal parts. Take care that the oil does not touch the optical parts of instruments, or leather or canvas fittings. Protect materiel not in use with covers as far as possible. Keep ammunition in sealed containers.

b. Ordinary fabrics offer practically no protection against mustard gas or lewisite. Rubber and oilcloth, for example, will be penetrated within a short time. The longer the period of exposure, the greater the danger, when apparel made of either of these materials is worn. Rubber boots contaminated with mustard gas may offer a grave danger to men who wear them several days after the attack. Impermeable clothing, designed to prevent penetration of chemicals, will resist penetration almost indefinitely, but the maximum time such clothing can be worn is from 5 to 10 minutes in summer and about 30 minutes in winter.

38. DECONTAMINATION.

a. For the removal of liquid vesicants (mustard, lewisite, etc.) from materiel, the following steps should be taken:

b. Protection of Personnel.

(1) For all of these operations a service gas mask and a complete suit of protective clothing, either permeable or impermeable, depending upon the type of contamination, must be worn. Immediately after removing the suit, a thorough bath with soap and water (preferably hot) must be taken.

LIGHT ARMORED CAR M8

If any skin areas have come in contact with liquid or vapor mustard gas, or if the vapor of mustard has been inhaled, it is imperative that complete first-aid measures be given within 5 minutes to be effective as a preventive. First aid must be prompt for little can be done later than 20 to 30 minutes after exposure.

(2) Casualties caused by vesicants (mustard, lewisite, etc.) or by lung irritants (phosgene, all vesicants, etc.) should be immediately removed from the contaminated area.

(a) *Vesicant Casualties.* Remove the contaminated clothing. If the face has been exposed, wash the eyes and rinse the nose and throat with a saturated boric acid, weak sodium bicarbonate, or common salt solution. Mustard burns or skin areas wet with liquid mustard should be immediately and repeatedly swabbed with a solvent, such as kerosene, any oil, alcohol, or CARBON TETRACHLORIDE; then wash thoroughly with soap and water.

(b) *Lung Irritant Casualties.* To reduce his oxygen requirements, make the casualty lie down. Keep him warm and give him nonalcoholic stimulants such as hot coffee or tea. He should be evacuated as soon as possible as an absolute litter case.

(c) Complete first-aid instructions to supplement the above general instructions are contained in FM 21-40.

(3) Decontaminate garments exposed to vesicants. If impermeable clothing has been exposed to vapor only, it may be decontaminated by hanging in the open air, preferably in sunlight, for several days. It may also be cleaned by steaming for 2 hours. If impermeable clothing has been contaminated with liquid vesicant gases, steam it for 6 to 8 hours. Various kinds of steaming devices can be improvised from equipment available in the field.

c. Procedure.

(1) Commence by freeing materiel of dirt through the use of sticks, rags, etc. Sticks, rags and other cleaning items used in decontamination must be burned or buried immediately after their use.

(2) If the surface of the materiel is coated with grease or heavy oil, remove it before decontamination is begun. For this cleaning, use SOLVENT, dry-cleaning, or other available solvents for oil, applied on cloths attached to the ends of sticks.

(3) Decontaminate the painted surfaces of the materiel with bleaching mixture made by mixing equal parts by weight of AGENT, decon-

MATERIEL AFFECTED BY CHEMICALS

taminating (chloride of lime), and water. So large a proportion of bleaching powder is added to the water that only a small part is dissolved; therefore, a suspension, or "slurry" is formed. This slurry should be swabbed over all surfaces. Wash off thoroughly with water; then dry and oil all surfaces.

(4) All unpainted metal parts of materiel that have been exposed to any gas except mustard and lewisite must be cleaned as soon as possible with SOLVENT, dry-cleaning, or ALCOHOL, denatured, grade 2, and wiped dry. All parts should then be coated with oil.

(5) All unpainted metal parts and instruments exposed to mustard or lewisite must be decontaminated with AGENT, decontaminating, non-corrosive, mixed 1 part solid to 15 parts solvent (ACETYLENE TETRACHLORIDE), by weight. If this is not available, use warm water and soap. Bleaching slurry must not be used because of its corrosive action on unpainted metal parts. After decontamination, wipe all metal surfaces dry and coat them lightly with engine oil, except the surfaces of small arms, which must be coated with OIL, lubricating, preservative, light. Instrument lenses may be cleaned only with PAPER, lens, tissue, using a small amount of ALCOHOL, ethyl, grade 1.

(6) If AGENT, decontaminating (chloride of lime), is not available, materiel may be temporarily cleaned with large volumes of hot water; however, mustard gas lying in joints or in leather or canvas webbing is not removed by this procedure and will remain a constant source of danger until the materiel can be properly decontaminated. Because all mustard gas washed from materiel lies unchanged on the ground, the area should be plainly marked with warning signs before abandonment.

(7) Leather or canvas webbing that has been contaminated should be scrubbed thoroughly with bleaching slurry. If this treatment is believed insufficient, it may be necessary to burn or bury such materiel.

(8) Ammunition which has been exposed to vesicant gas must be thoroughly cleaned before firing. To clean ammunition use AGENT, decontaminating, noncorrosive, or if this is not available, strong soap and warm water. After cleaning, wipe all ammunition dry with clean cloths. *Do not use dry powdered AGENT, decontaminating (chloride of lime) (used for decontaminating certain types of materiel on or near ammunition supplies), as flaming occurs when it touches liquid mustard.*

(9) Detailed information on decontamination is contained in FM 21-40 and TM 3-220.

LIGHT ARMORED CAR M8

39. SPECIAL PRECAUTIONS FOR AUTOMOTIVE MATERIEL.

- a. When a vehicle has been subjected to gas attack with the engine running, service the air cleaner by removing the oil, flushing with SOLVENT, dry-cleaning, and refilling with the proper grade of oil.
- b. Instrument panels should be cleaned in the same manner as instruments.
- c. Discard contaminated seat cushions.
- d. Washing the compartments thoroughly with bleaching slurry is the most that can be done in the field. In warm weather, operators should constantly be on the alert for slow vaporization of the mustard or lewisite.
- e. Decontaminate the exterior surfaces of the vehicle with bleaching slurry. Repainting may be necessary after this operation.

PART TWO — Organization Instructions

Section X

GENERAL INFORMATION ON MAINTENANCE

	Paragraph
Scope	40

40. SCOPE.

a. Organization Maintenance.

(1) SCOPE. The scope of maintenance and repair by the crew and other units of the using arms is determined by the availability of suitable tools, availability of necessary parts, capabilities of the mechanics, time available, and the tactical situation. All of these are variable and no exact system of procedure can be prescribed.

(2) ALLOCATION OF MAINTENANCE. Indicated below are the maintenance duties for which tools and parts have been provided for the using arm personnel. Other replacements and repairs are the responsibility of ordnance maintenance personnel but may be performed by using arm personnel when circumstances permit, within the discretion of the commander concerned. Echelons and words as used in this list of maintenance allocations are defined as follows:

SECOND ECHELON: Line organization regiments, battalions, companies, detachments, and separate companies (first and second echelons).

THIRD ECHELON: Ordnance light maintenance companies, ordnance medium maintenance companies, ordnance divisional maintenance battalions, and post ordnance shops.

FOURTH ECHELON: Ordnance heavy maintenance companies, and service command shops.

FIFTH ECHELON: Ordnance base regiments, ordnance bases, arsenals, and manufacturers' plants.

SERVICE (Including preventive maintenance): Refer to AR 850-15, paragraph 23 a (1) and (2).	Consists of servicing, cleaning, lubricating, tightening bolts and nuts, and making external adjustments of subassemblies or assemblies and controls.
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LIGHT ARMORED CAR M8

- REPLACE: Refer to AR 850-15, paragraph 23 a (4).

Consists of removing the part, subassembly or assembly from the vehicles and replacing it with a new or reconditioned or rebuilt part, subassembly, or assembly, whichever the case may be.
- REPAIR: Refer to AR 850-15, paragraph 23 a (3) and (5), in part.

Consists of making repairs to, or replacement of the part, subassembly, or assembly that can be accomplished without completely disassembling the subassembly or assemblies, and does not require heavy welding, or riveting, machining, fitting, and/or alining or balancing.
- REBUILD: Refer to AR 850-15, paragraph 23 a (5), in part, and (6).

Consists of completely reconditioning and replacing in serviceable condition any unserviceable part, subassembly, or assembly of the vehicle, including welding, riveting, machining, fitting, alining, balancing, assembling, and testing.

NOTE: Operations allocated will normally be performed in the echelon indicated by "X." Operations allocated to the echelons as indicated by "E" may be accomplished by the respective echelons in emergencies only.

ABSORBER, SHOCK AND LINKAGE	ECHELONS			
	2nd	3rd	4th	5th
Absorber assembly, shock and linkage—replace.....	X			
Absorber assembly, shock and linkage—repair.....		X		
Absorber assembly, shock and linkage—rebuild			E	X
AXLE, FRONT				
Arm, steering knuckle—replace.....	E	X		
*Axle assembly—replace.....		X		
Axle assembly—repair.....		X		
Axle assembly—rebuild.....			E	X
Bearing, wheel—replace (adjust).....	X			
Drum, brake—replace.....	X			
Gear, bevel and pinion—adjust.....		X		
Retainer, grease, wheel—replace.....	X			
Rod, tie—replace.....	X			

*The second echelon is authorized to remove and reinstall engine and transmission assemblies, transfer unit controlled differential assembly, and other items marked by asterisk; however, when it is necessary to replace an item marked by an asterisk with a new or rebuilt part, subassembly, or unit assembly, the assembly marked by asterisk will not be removed from the vehicle by the second echelon until authorization is received from a higher echelon.

GENERAL INFORMATION ON MAINTENANCE

AXLE, FRONT — (Cont.)

	2nd	ECHELONS		
		3rd	4th	5th
Rod, tie—repair.....		X		
Seal, oil, trunnion housing—replace.....	E	X		
Shaft—replace		X		
Stop, steering knuckle—replace (adjust).....		X		
Wheel alinement, camber and caster—service (check)....		X		
Wheel alinement, camber and caster (adjust).....			E	X
Wheel alinement, toe-in—service (adjust).....	X			

AXLE, REAR

*Axle assembly—replace.....		X		
Axle assembly—repair.....		X		
Axle assembly—rebuild.....			E	X
Bearing, wheel—replace (adjust).....	X			
Drum, brake—replace.....	X			
Gear, bevel and pinion—adjust.....		X		
Retainer, grease, wheel—replace.....	X			
Shaft—replace.....	X			

BRAKES, SERVICE (FOOT)

Brakes—service (adjust).....	X			
Cylinder assembly, master—service, replace	X			
Cylinder assembly, master—repair.....		X		
Cylinder assembly, master—rebuild.....			X	
Cylinder assembly, power (Hydrovac)—replace.....	X			
Cylinder assembly, power (Hydrovac)—repair.....		E	X	
Cylinder assembly, power (Hydrovac)—rebuild.....			E	X
Cylinder assembly, wheel—replace.....	X			
Cylinder assembly, wheel—repair.....		X		
Cylinder assembly, wheel—rebuild.....			X	
Hose, flexible—replace.....	X			
Lines—replace, repair.....	E	X		
Shoe assembly—replace.....	X			
Shoe assembly—repair (reline).....		X		

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LIGHT ARMORED CAR M8

	ECHELONS			
	2nd	3rd	4th	5th
BRAKES (HAND-PARKING)				
Controls—replace.....	X			
Controls—repair.....		X		
Shoe assembly—replace (adjust).....	X			
Shoe assembly—repair (reline).....		X		
CASE, TRANSFER				
Band, brake—replace (adjust).....	X			
Band, brake—repair (reline).....		X		
*Case assembly—replace.....		X		
Case assembly—repair.....		E		
Case assembly—rebuild.....			E	X
Controls—replace.....	X			
Controls—repair.....		X		
Drum, brake—replace.....	X			
CLUTCH				
Clutch—replace.....	E	X		
Clutch—repair.....		X		
Clutch—rebuild.....			E	X
Housing, bell—replace.....		X		
Housing, bell—rebuild (recondition).....			X	
Lines—replace, repair.....	E	X		
Pedal, free travel—service (adjust).....	X			
COOLING SYSTEM				
Hose—replace.....	X			
Pipe—replace.....	X			
Radiator assembly—replace.....	X			
Radiator assembly—repair.....		X		
Radiator assembly—rebuild.....			E	X
Tank, surge—replace.....	X			
Tank, surge—repair.....		X		
ELECTRICAL SYSTEM				
Battery—service, recharge, replace.....	X			
Battery—repair.....		X		
Battery—rebuild.....			E	X
Box, apparatus assembly, generator control—replace.....	X			

*The second echelon is authorized to remove and reinstall engine and transmission assemblies, transfer unit controlled differential assembly, and other items marked by asterisk; however, when it is necessary to replace an item marked by an asterisk with a new or rebuilt part, subassembly, or unit assembly, the assembly marked by asterisk will not be removed from the vehicle by the second echelon until authorization is received from a higher echelon.

GENERAL INFORMATION ON MAINTENANCE

ELECTRICAL SYSTEM — (Cont.)	ECHELONS			
	2nd	3rd	4th	5th
Box, apparatus assembly, generator control—repair.....		X		
Box, apparatus assembly, generator control—rebuild.....			X	
Cables, battery—replace.....	X			
Lamps—service, replace.....	X			
Siren—replace.....	X			
Siren—repair.....		X		
Siren—rebuild.....			X	
Switch assemblies—replace.....	X			
Switch assemblies—repair.....		X		
Wiring—replace.....	X			
ENGINE				
Bearing, connecting rod—replace.....		E	E	X
Bearing, crankshaft, main—replace.....		E	E	X
Belt, fan and generator—replace.....	X			
Blades, fan and hub assembly—replace.....	E	X		
Blades, fan and hub assembly—rebuild.....		E	X	
Block, cylinder—rebuild (recondition).....			E	X
Carburetor assembly—replace.....	X			
Carburetor assembly—repair.....		X		
Carburetor assembly—rebuild.....			X	
Cleaner, air—replace.....	X			
Cleaner, air—repair.....		X		
Coil assembly, ignition—replace.....	X			
Condenser, distributor—replace.....	X			
Crankshaft—rebuild (recondition).....			E	X
Distributor assembly—replace.....	X			
Distributor assembly—repair.....		X		
Distributor assembly—rebuild.....			X	
*Engine assembly—replace.....		X		
Engine assembly—repair.....		X		
Engine assembly—rebuild.....			E	X

*The second echelon is authorized to remove and reinstall engine and transmission assemblies, transfer unit controlled differential assembly, and other items marked by asterisk; however, when it is necessary to replace an item marked by an asterisk with a new or rebuilt part, subassembly, or unit assembly, the assembly marked by asterisk will not be removed from the vehicle by the second echelon until authorization is received from a higher echelon.

LIGHT ARMORED CAR M8

ENGINE — (Cont.)	ECHELONS			
	2nd	3rd	4th	5th
Filter assembly, fuel—service, replace.....	X			
Filter assembly, oil—service, replace.....	X			
Flywheel—replace		X		
Flywheel—rebuild (recondition).....			X	
Gasket, cylinder head—replace.....	X			
Gasket, manifold—replace.....	X			
Gears, timing—replace.....		E	X	
Generator—replace	X			
Generator—repair		X		
Generator—rebuild			X	
Head, cylinder—replace, repair.....		X		
Head, cylinder—rebuild (recondition).....			E	X
Line, oil (external)—replace.....	X			
Line, oil (internal)—replace.....		E	X	
Manifolds—replace	E	X		
Manifolds—repair		E	X	
Motor, starting—replace.....	X			
Motor, starting—repair.....		X		
Motor, starting—rebuild.....			X	
Pan assembly, oil—clean and replace gaskets.....	X			
Pan assembly, oil—replace.....		X		
Pin, piston—replace.....		E	E	X
Pistons and rings—replace.....		E	E	X
Plugs, spark—replace.....	X			
Plugs, spark (two-piece)—repair.....		X		
Points, breaker, distributor—replace.....	X			
Pulleys, crankshaft, fan, water pump—replace.....	E	X		
Pump assembly, fuel—service, replace.....	X			
Pump assembly, fuel—repair.....	E	X		
Pump assembly, fuel—rebuild.....		E	X	
Pump assembly, oil—replace.....	E	X		
Pump assembly, oil—repair.....		X		
Pump assembly, oil—rebuild.....			X	
Pump assembly, water—replace.....	X			
Pump assembly, water—repair.....		X		
Pump assembly, water—rebuild.....			X	

GENERAL INFORMATION ON MAINTENANCE

		ECHELONS			
		2nd	3rd	4th	5th
ENGINE — (Cont.)					
Rod, connecting—replace.....			E	E	X
Strainer, oil—clean, replace.....	E		X		
Thermostat—replace	X				
Valve—repair			X		
Valve, lash—adjust.....	X				
Ventilator, crankcase—replace, service (clean).....	X				
Wiring, ignition—replace.....	X				
EXHAUST SYSTEM					
Muffler and exhaust pipes—replace.....	X				
EXTINGUISHING SYSTEM, FIRE					
Extinguisher, hand, CO ₂ -type—replace.....	X				
Extinguisher, hand, CO ₂ -type—repair, refill.....			X		
Extinguisher, hand, CO ₂ -type—rebuild.....				E	X
FRAME					
Frame assembly—replace			E	X	
Frame assembly—repair, rebuild.....				E	X
Pintle assembly—replace.....	X				
Pintle assembly—repair.....			X		
FUEL SYSTEM					
Filter (in fuel line)—service, clean, replace.....	X				
Lines (fuel)—replace, repair.....	X				
Tank—service, replace.....	X				
Tank—repair.....			X		
HULL					
Boxes and racks, ammunition—repair.....			X		
Closure plates—replace, repair.....	E		X		
Covers, engine compartment—replace, repair.....	E		X		
Hull assembly—replace.....			X		
Hull assembly—repair.....			E	X	
Hull assembly—rebuild.....				E	X
Protectoscope—replace.....	X				
Ring assembly, turret—replace.....	X				
Ring assembly, turret—repair.....			X		
Ring assembly, turret—rebuild.....				X	
Rings, lifting—replace, repair.....			X		

LIGHT ARMORED CAR M8

		ECHELONS			
		2nd	3rd	4th	5th
HULL — (Cont.)					
Seats—replace.....	X				
Seats—repair.....			X		
Windshield assembly ($\frac{3}{4}$ -in. armor plate)—replace.....			X		
METAL, SHEET					
Boxes, tool and ration—replace.....	X				
Boxes, tool and ration—repair.....	X				
Fenders—replace.....	X				
Fenders—repair.....			X		
INSTRUMENTS AND GAGES (Not listed individually)					
Instruments and gages—replace.....	X				
Instruments and gages—rebuild.....				E	X
MISCELLANEOUS					
Head, speedometer—replace.....	X				
Head, speedometer—rebuild.....				E	X
Shaft, flexible drive assembly, speedometer—replace.....	X				
Shaft, flexible drive assembly, speedometer—repair.....			X		
SHAFTS, PROPELLER AND UNIVERSAL JOINTS					
Shaft assembly, with universal joints—replace.....	X				
Shaft assembly, with universal joints—repair.....			X		
Shaft assembly, with universal joints—rebuild.....				E	X
STEERING SYSTEM					
Arm (pitman)—replace	X				
Gear assembly, steering—replace.....	E		X		
Gear assembly, steering—repair.....			X		
Gear assembly, steering—rebuild.....				E	X
Link assembly, drag—service, replace.....	X				
Link assembly, drag—repair.....			X		
SUSPENSION SYSTEM					
Bearing, bogie shaft—service, replace.....	X				
Bracket, bogie—replace.....	E		X		
Bracket, bogie—rebuild (recondition).....				E	X
Rods, torque—replace (adjust)	E		X		
Rods, torque—rebuild.....				E	X
Shackle and pin—replace.....	X				

GENERAL INFORMATION ON MAINTENANCE

SUSPENSION SYSTEM — (Cont.)	ECHELONS			
	2nd	3rd	4th	5th
Shaft, bogie—replace.....		X		
Spring assembly—replace.....	X			
Spring assembly—repair.....		X		
Spring assembly—rebuild.....			E	X
TIRES				
Casing and tube—service, replace.....	X			
Casing—repair			E	X
Tube, inner—repair.....	E	E	X	
TRANSMISSION				
Controls—replace	X			
Controls—repair		X		
Controls—rebuild			X	
*Transmission assembly—replace.....		X		
Transmission assembly—repair		X		
Transmission assembly—rebuild			E	X
TURRET				
Mechanism, turret traversing—replace.....	X			
Mechanism, turret traversing—repair.....		E	X	
Mechanism, turret traversing—rebuild.....			E	X
Seats—replace	X			
Seats—repair		X		
Turret assembly—replace, repair.....			X	
VEHICLE ASSEMBLY				
Light Armored Car M8—service.....	X			
Light Armored Car M8—rebuild (with serviceable assemblies)			X	E
WHEELS				
Wheels—replace	X			
Wheels—rebuild			E	X

*The second echelon is authorized to remove and reinstall engine and transmission assemblies, transfer unit controlled differential assembly, and other items marked by asterisk; however, when it is necessary to replace an item marked by an asterisk with a new or rebuilt part, subassembly, or unit assembly, the assembly marked by asterisk will not be removed from the vehicle by the second echelon until authorization is received from a higher echelon.

LIGHT ARMORED CAR M8

Section XI

EQUIPMENT AND SPECIAL TOOLS

	Paragraph
Special tools and equipment.....	41
Care of equipment.....	42

41. SPECIAL TOOLS AND EQUIPMENT.

a. The list of organization equipment with the location of the various tools was not available at the time this book went to press. A revision of this book is now in preparation and the list of special equipment and tools as well as the source of supply will be given in the revised book.

42. CARE OF EQUIPMENT.

a. An accurate record of all tools and accessories should be kept in order that their location and condition may be known at all times. Items becoming lost or unserviceable should be immediately replaced. All tools and equipment should be cleaned and in proper condition for further use before being returned to their location. Frequent inspection and oiling is necessary to prevent corrosion.

Section XII

ORGANIZATION SPARE PARTS AND ACCESSORIES

	Paragraph
Organization spare parts.....	43
Accessories	44

43. ORGANIZATION SPARE PARTS.

a. A set of organization spare parts is supplied to the using arms for field replacement of those parts most likely to become broken, worn or otherwise unserviceable. The set is kept complete by requisitioning new parts for those used. Organization spare parts are listed in pertinent standard nomenclature lists. Care of organization spare parts is covered in section VII.

44. ACCESSORIES.

a. Accessories include tools and equipment required for such disassembling and assembling as the using arms are authorized to perform, and for the cleaning and preservation of the gun carriage, sighting and fire control equipment, ammunition, etc. They also include chests, covers, tool rolls, and other items necessary to protect the materiel when it is not in use, or when traveling. Accessories should not be used for purposes other than as prescribed, and when not in use should be properly stored.

LIGHT ARMORED CAR M8

Section XIII

ENGINE

	Paragraph
General description and tabulated data.....	45
Preventive maintenance	46
Trouble shooting	47
Lubrication system	48
Replacement	49
Valve mechanism	50
Manifolds	51
Motor mounts	52
Oil pan	53
Oil pump	54
Cylinder head	55
Oil filter	56
Crankcase breather	57
Exhaust system	58

45. GENERAL DESCRIPTION AND TABULATED DATA.

a. **Description of Engine.** The Light Armored Car M8 is powered with a Hercules JXD engine (with special front cover, oil pan, oil pump, manifolds, fan and generator drive). The valve arrangement is L-type. The push rods are adjustable for setting valve clearance. The engine is liquid-cooled with thermostatic temperature control.

b. **Tabulated Data:**

Make	Hercules
Type	JXD
Weight, with transmission and accessories (approx.).....	1,030 lb
Horsepower.....	110 at 3,200 rpm
Number of cylinders.....	6
Bore	4 in.
Stroke	4½ in.
Piston displacement.....	320 cu in.
Compression ratio.....	6.5 to 1

ENGINE

Direction of rotation (viewed from rear engine):

Crankshaft	Clockwise
Starter	Counterclockwise
Generator speed.....	1.73 to crankshaft speed
Valve minimum clearance	
Exhaust	0.010 in.
Intake	0.010 in.
Carburetor, make and model.....	Zenith 29W-12
Numbering of cylinders from rear to front.....	1-2-3-4-5-6
Firing order.....	1-5-3-6-2-4

c. **Location and Mountings.** The engine is located in the rear of the vehicle and mounted at four points. The rear mounting pads are on each side of the gear cover and are part of the cover. The front mountings are attached to pads on each side of the flywheel housing. Both the front and rear of the engine is insulated from the vehicle by rubber between the mounting pads and the vehicle.

d. **Accessories.** The engine accessories consist of the following and are described elsewhere in this book:

- (1) Generator (par. 86).
- (2) Starting motor (par. 91).
- (3) Distributor and coil (pars. 61 and 62).
- (4) Fuel pump (par. 72).
- (5) Carburetor (par. 68).
- (6) Engine thermostat (par. 82).
- (7) Temperature gage (engine unit) (par. 95).
- (8) Oil pressure gage (engine unit) (par. 97).

e. **Definition of Term "Left," "Right," "Front," and "Rear."** Throughout this book the flywheel or the transmission end is referred to as the "front." "Left" or "right" is as viewed from the rear of the vehicle, when facing the same direction the vehicle is headed.

46. PREVENTIVE MAINTENANCE.

a. Preventive maintenance of the engine is covered in section V. Briefly stated the operations are: Clean and refill carburetor air cleaner as often as necessary; check the oil supply in oil pan daily. Replenish coolant in radiator as often as may be required. Inspect for leaks as outlined in paragraph 27 a (1), and make necessary corrections. In case of engine trouble, refer to paragraph 47.

LIGHT ARMORED CAR M8

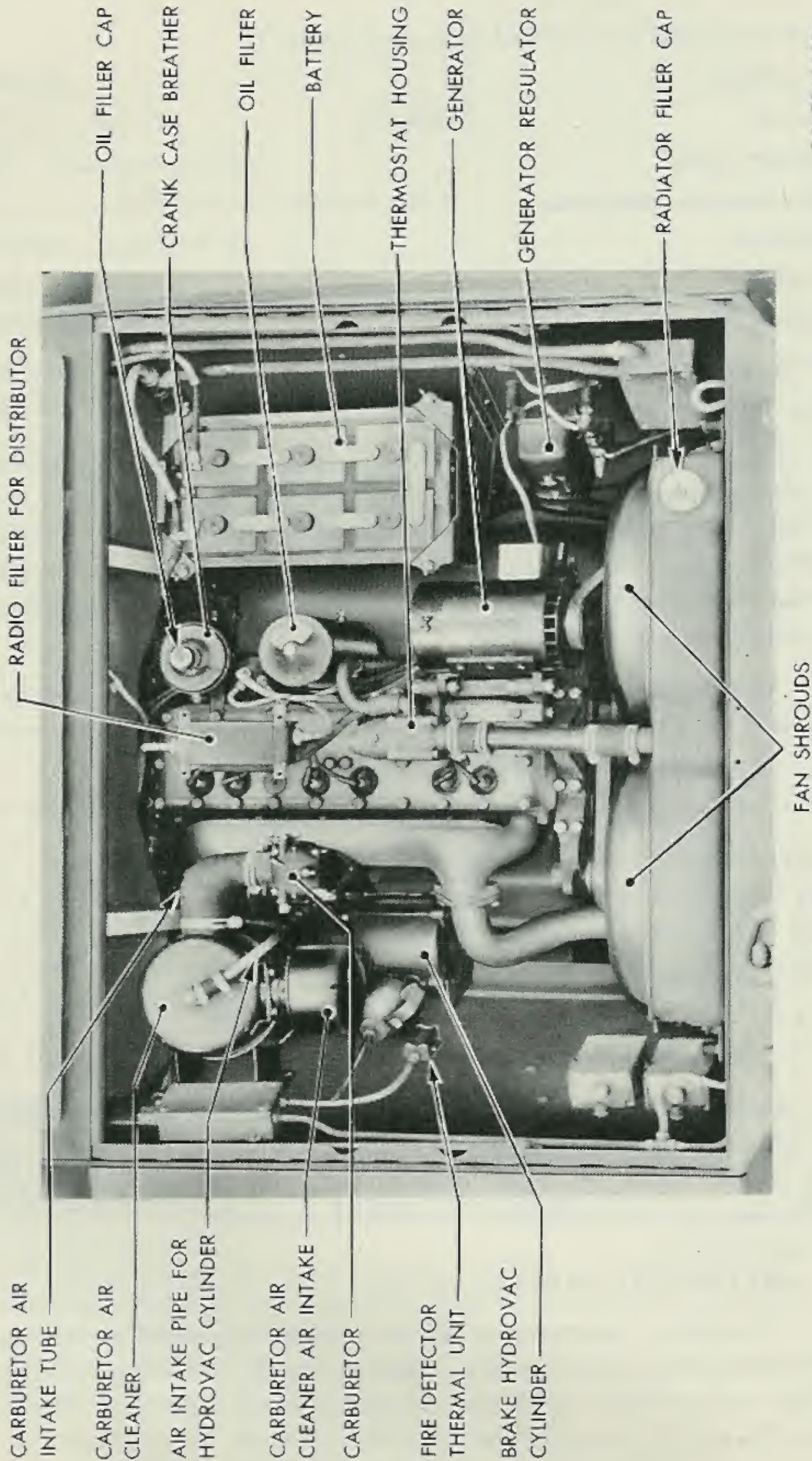


Figure 13 — Engine Compartment from Above

RA PD 28005

ENGINE**47. TROUBLE SHOOTING.**

a. **General.** Difficulty in determining the exact cause of engine trouble will be encountered at times because of the number of sources to which a given symptom may be attributed. The best method of trouble shooting is to consider the possible causes and eliminate them, one by one, starting with the most probable cause. Subparagraphs b through n is devoted to the most common engine troubles and their probable cause and remedy. Its purpose is to minimize, in so far as possible, the time wasted in ascertaining the source of given trouble.

b. **Voltmeter Reading Remains Unchanged and the Engine Fails to Turn Over When the Starter Button is Pressed.**

Probable Cause	Probable Remedy
Battery master switch open.	Close master switch.
Starter button circuit incomplete.	Tighten connections and repair or replace wires.
Starter button defective.	Replace (par. 99).
Circuit to starting motor incomplete.	Tighten connections or repair or replace cable.
Battery not grounded.	Clean and tighten connections.
Starting motor defective.	Replace (par. 91 b).

c. **Voltmeter Reading Drops to Low Limit and the Engine Fails to Turn Over When the Starter Button is Pressed.**

Battery is undercharged.	Recharge, replace (par. 88 d) and correct cause (par. 85 d).
Starting motor is shorted.	Replace starting motor (par. 91 b).
Starter circuit is shorted.	Repair or replace cables.

d. **Starting Motor Runs but Engine Fails to Turn Over When Starter Button is Pressed.**

Starter drive faulty.	Replace.
Starter gear on flywheel faulty.	Notify ordnance maintenance personnel.

LIGHT ARMORED CAR M8

Probable Cause

Probable Remedy

e. Engine Turns Over but Does Not Start.

Ignition switch off.	Turn on.
Fuel shutoff valve closed.	Open.
Fuel tank empty.	Refill.
Engine flooded (overchoked).	Place throttle in wide open position and turn engine over with the starter 5 or 6 revolutions.
Ignition primary shorted or broken.	Replace.
No fuel in carburetor bowl.	See paragraph 47 f below.
Automatic choke inoperative.	Adjust (par. 71 b).
No spark at spark plugs.	See paragraph 47 g.
Ignition switch faulty.	Replace.
Ignition timing (engine backfires but does not start).	Time ignition (par. 63).

f. No Fuel in the Carburetor Bowl.

Fuel shutoff valve closed.	Open.
Fuel filter clogged.	Clean or replace.
Fuel lines clogged.	Blow out or replace.
Fuel pump faulty.	Replace (par. 72 d).

g. No Spark at One or More Spark Plugs.

Primary ignition wires shorted or broken.	Replace.
High tension wires broken or faulty insulation.	Replace (par. 110 c).
Spark plugs shorted.	Replace.
Ignition switch faulty.	Replace (par. 60 b).
Distributor cap shorted.	Replace.
Breaker points faulty.	Replace (par. 62 c (3)).

ENGINE

Probable Cause	Probable Remedy
Condenser faulty.	Replace.
Distributor faulty.	Replace (par. 62 b).
Ignition coil faulty.	Replace (par. 61 b).
h. Ignition Timing (Engine Backfires but Does Not Start).	
Ignition out of time.	Retime (par. 63).
Spark plug wires in wrong sockets of the distributor cap.	Install as numbered on cap.
i. If Engine Runs Unevenly and Black Smoke is Emitted from the Exhaust.	
Fuel mixture too rich due to:	
Carburetor float level too high.	Replace carburetor (par. 68 c and d).
Fuel pump pressure too high.	Replace fuel pump (par. 72 d).
Automatic choke sticking.	Adjust (par. 71 b) and free linkage.
j. If Engine Runs Unevenly and Backfires Through the Carburetor.	
Fuel mixture too lean due to:	
Engine cold.	Run engine until normal temperature is reached (par. 9).
Carburetor float lever too low.	Replace carburetor (par. 68 c and d).
Dirt in carburetor.	Replace carburetor (par. 68 c and d).
Fuel pump pressure too low.	Replace fuel pump (par. 72 d).
Air leak at carburetor gasket or intake manifold gasket.	Tighten or replace gasket.
Air leak at vacuum line.	Tighten or replace line.
Automatic choke not operating when cold.	Replace (71 c).

LIGHT ARMORED CAR M8

Probable Cause	Probable Remedy
Ignition trouble due to:	
Distributor cap cracked or shorted.	Replace cap.
Distributor rotor shorted.	Replace.
Spark plug wires in wrong sockets in distributor cap	Install as numbered on distributor cap.
High tension wires (broken or faulty insulation).	Replace (par. 65).
Spark plug gap too wide.	Reset gap (par. 64 a).
Engine valves due to:	
Insufficient valve clearance.	Reset (par. 50 c).
Sticky valve guides, broken valve springs, and valve seats leaking.	Notify ordnance maintenance personnel.
k. Engine Overheating.	
Water low.	Refill.
Air flow restricted through radiator core.	Clean (par. 78 b).
Loose fan belts.	Adjust (par. 81 b).
Engine operating with late spark.	Time ignition (par. 63).
Faulty thermostat.	Replace (par. 82 b).
l. Lack of Power.	
Throttle not fully open.	Adjust (par. 70 b).
Spark plug gap too wide.	Reset spark plugs (par. 64 a).

ENGINE

Probable Cause	Probable Remedy
Brakes dragging.	Adjust (par. 159).
Ignition timing, late.	Time ignition (par. 63).
Low compression.	Notify ordnance maintenance personnel.
Valve timing.	Notify ordnance maintenance personnel.
Clutch slipping.	Adjust (par. 118); replace (par. 119 b).
Overchoke.	Adjust automatic choke (par. 71 b).
m. Low Oil Pressure.	
Oil supply low.	Refill.
Overdiluted oil.	Change oil.
Faulty oil pressure regulator.	Notify ordnance maintenance personnel.
Excessive bearing clearance.	Notify ordnance maintenance personnel.
n. Abnormal Engine Noise.	
Valve mechanism and camshaft noise occurs once for every 2 revolutions of the engine due to:	
Broken or scored push rod.	Notify ordnance maintenance personnel.
Broken valve springs.	Notify ordnance maintenance personnel.
Excessive push rod gap.	Adjust (par. 50 c).
Connecting rod bearing knock.	Notify ordnance maintenance personnel.
Crankshaft main bearing knock.	Notify ordnance maintenance personnel.

LIGHT ARMORED CAR M8

Probable Cause

Probable Remedy

Engine pinging or spark knock
due to:

Excessive carbon formation.

Remove heads and clean carbon
(par. 55 b).

Ignition timing too early.

Time ignition (par. 63).

Wrong type spark plug.

Replace with correct type (par. 64
a).

Low octane fuel.

Drain and refill with correct quan-
tity (par. 5 i).

Spark fails to retard due to
broken distributor governor
springs or sluggish action of
governor weights.

Replace distributor (par. 62 b).

48. LUBRICATION SYSTEM.

a. **Oil Pump.** The oil pump is of the gear-type and is fastened to the cylinder block so that the suction end is in the oil pan and needs no priming.

b. **Oil Circulation.** The oil under pressure is delivered through suitable connections to a drilled passage in the crankcase. This drilled passage extends from front to rear of the engine on the side opposite the camshaft. The passage is closed at both ends by means of plugs. Radial holes are drilled from the crankshaft main bearings to meet this horizontal passage. These holes permit oil to be delivered under pressure to the main bearings and through drilled holes in the crankshaft to the connecting rod bearings. The cylinder bore, push rods, and valve stems are lubricated by means of oil mist thrown off around the connecting rod bearings.

c. **Oil Pressure.** The oil pressure setting is 26 pounds at 1,600 revolutions per minute when the oil is hot (about 140 degrees). At idling speed this results in a pressure between 5 and 10 pounds. At speeds higher than 1,600 revolutions per minute the pressure will be somewhat higher; likewise when the oil is cold the pressure will be higher. Oil pressure will also vary with different grades (viscosities) of oil.

d. **Oil Pressure Regulator.** The oil pressure should not be changed or judged to be too high or too low until the proper viscosity of oil being used is known and the engine warmed up to normal operating tempera-

ENGINE

ture. To change the oil pressure, remove the pipe plug on the right-hand side of the oil pan. With the use of a special crow foot wrench, the oil pressure can be adjusted through this opening. Using the special crow foot wrench, loosen lock nut and with a T-handle socket wrench, turn screw in for increasing the oil pressure and out for decreasing the pressure. After this adjustment is made the lock nut must be tightened.

e. **Oil Filter.** A Fram (No. 5266) oil cleaner is mounted on the right side of the engine. The cartridge is removable and should be changed at intervals specified in the lubrication instructions (par. 14).

49. REPLACEMENT.

a. Removal.

(1) **REMOVE ENGINE COMPARTMENT DOORS AND DOOR HINGE PLATE.** Remove the ground strap from each door. Remove the hinge pins from each door and lift the doors from the vehicle. Take out 2 screws from each end of the hinge plate. Remove 4 screws which hold the distributor filter box to the underside of the hinge plate and lift the plate from the vehicle.

(2) **DRAIN COOLING SYSTEM.** Loosen wing nut on drain cock cover at the bottom of the radiator on the right-hand side. The drain cock is lower than the engine and the cooling system will drain completely from this point.

(3) **DISCONNECT MUFFLER PIPE.** Remove the 2 bolts from the flange at the exhaust manifold and the 2 bolts from the flange at the muffler and remove the pipe.

(4) **REMOVE CARBURETOR AIR CLEANER.** Loosen clamp on air tube running from the air cleaner to the carburetor and remove the tube from the air cleaner. Loosen clamp from tube running to the brake Hydrovac cylinder and remove the tube. Take out 4 screws from the mounting flange and remove the cleaner from the hull.

(5) **REMOVE BATTERY.** Remove the battery cables from battery. Remove 4 wing nuts from battery cover frame and lift the battery from its bracket.

(6) **REMOVE GENERATOR.** Take out 4 screws from the cover on the terminal box (fig. 30) and remove the cover. Disconnect wires from the field and armature terminals. Remove the 4 screws holding the terminal box on the generator and lift the terminal box wires and conduit from the generator. Remove 2 bolts from the mounting bracket and 1 screw from the adjusting bracket and lift generator from the engine.

LIGHT ARMORED CAR M8

(7) REMOVE FAN BELT IDLER BRACKET. Take out 4 cap screws from the idler bracket and remove the idler bracket and pulley.

(8) REMOVE LEFT-HAND FAN AND HUB ASSEMBLY. Take out 2 cap screws from the fan bracket and remove the left-hand fan assembly.

(9) REMOVE FAN AND SHROUD FROM RIGHT-HAND SIDE. Take out 2 cap screws from the fan bracket. Remove 6 wing nuts and 2 cap screws which secure the shroud to the radiator, and remove the fan and shroud assembly from the engine compartment.

(10) REMOVE RADIATOR. Remove bolt and springs from the upper support bracket on each side of the radiator. Take out the cap screws from the lower bracket on each side. Loosen the hose clamps from the upper and lower hose connection, and lift the radiator from the vehicle.

(11) REMOVE MISCELLANEOUS WIRES AND TUBES. Remove fuel line from the fuel pump inlet. Remove primer tube from tee at front of the intake manifold. Remove heat indicator engine unit from the cylinder head. Remove wire from oil pressure gage engine unit. Disconnect wires and conduit from the radio filter for the distributor (fig. 13). Disconnect the hydraulic tube from the clutch slave cylinder, and the hydraulic tube support bracket from top of the transmission.

(12) DISCONNECT PROPELLER SHAFT FROM UNIVERSAL JOINT. Unscrew grease seal retainer at universal slip joint (fig. 37). The propeller shaft will pull from the slip joint in the universal joint as the engine is removed, leaving the universal joint on the transmission.

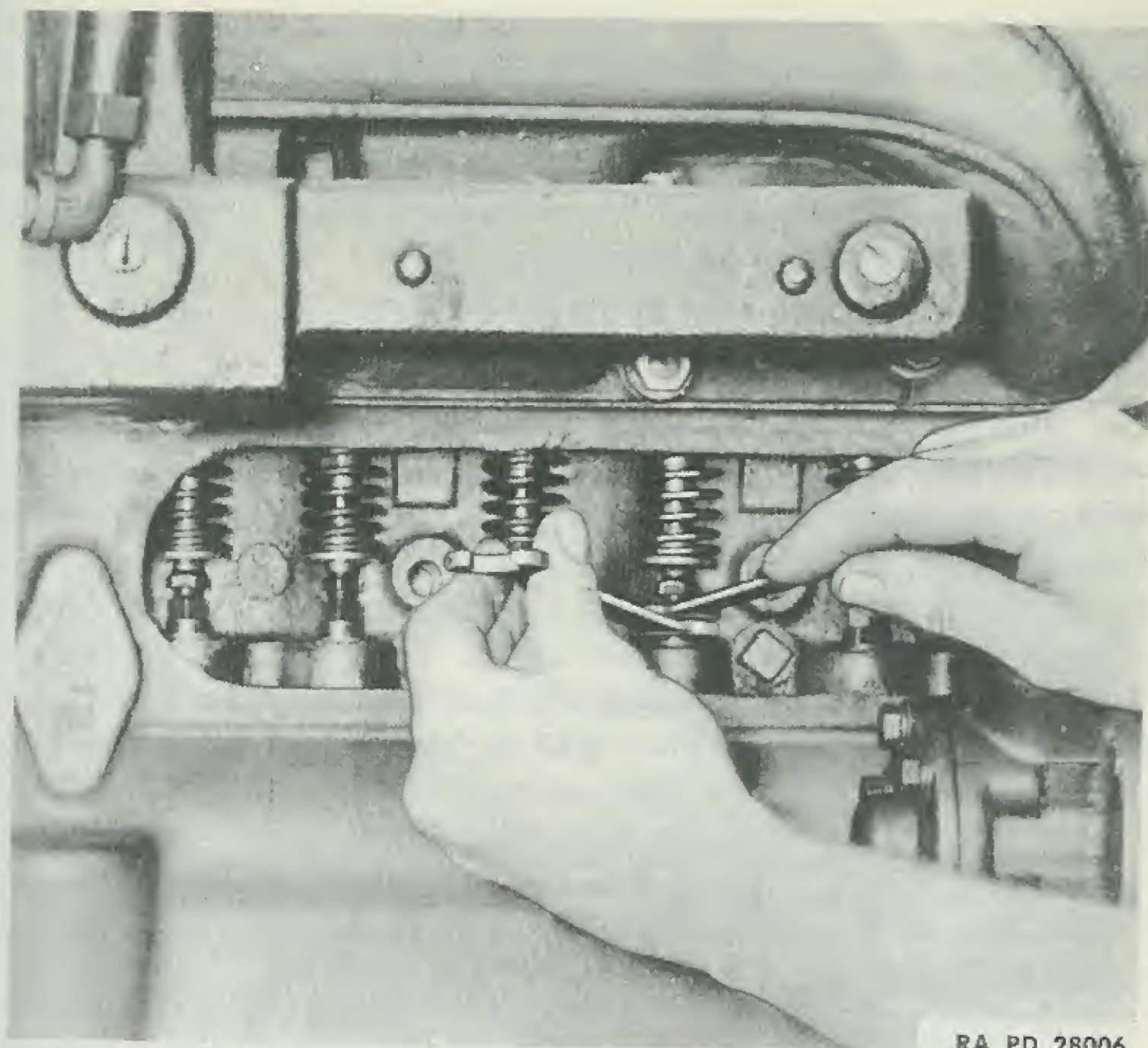
(13) DISCONNECT TRANSMISSION SHIFT ROD. Remove 2 bolts from the universal joint (transmission end), and slip the rod from its universal joint.

(14) REMOVE ENGINE SUPPORT BOLTS. Attach a lifting sling to the engine, and with a hoist support the weight of the engine while removing the support bolts. Remove nut from each of the rear supports and 4 screws from each of the front supports.

(15) REMOVE ENGINE FROM THE VEHICLE. Adjust the lifting sling so as to tilt the rear of the engine upward while lifting to provide clearance for the transmission in lifting engine from the engine compartment.

b. Installation. Reverse sequence of steps of removal procedure. Bleed hydraulic lines to clutch slave cylinder (par. 123).

ENGINE



RA PD 28006

Figure 14 — Adjusting Push Rods

50. VALVE MECHANISM.

a. **The Camshaft.** The camshaft runs in 4 bearings in the crankcase. These bearings are of the removable babbitt-lined type. The camshaft is gear driven by a gear on the crankshaft.

b. **Valves and Valve Push Rods.** The valve guides as well as the push rod guides are removable bushings pressed into the cylinder block. The intake valve heads are larger than the exhaust valves. Valve push rods are of the mushroom type and are provided with a screw and lock nut to allow adjustment of valve stem clearance.

c. **Adjust Push Rods.** Disconnect the vacuum tube from the valve cover and take out the 2 screws from each cover and remove the covers; the push rod for the intake and exhaust valve of each cylinder must be adjusted with the piston on the compression stroke. With a compression gage or equivalent in the spark plug hole of No. 1 cylinder, turn the engine until the piston of that cylinder is at top dead center on the compression stroke. Push rods must be adjusted so that both the intake

LIGHT ARMORED CAR M8

and the exhaust valve have 0.010 inch gap. To adjust, loosen lock nut and adjust the screw until the proper clearance is obtained on the intake and exhaust valve of No. 1 cylinder, using a feeler gage between the push rod and the valve stem (fig. 14). Recheck the clearance after tightening the lock nut. Repeat the procedure on the other 5 cylinders. Replace valve covers using a new gasket.

51. MANIFOLDS.

a. **Description.** The intake and exhaust manifolds are cast in one piece. The heat from the exhaust section of the manifold preheats the gases passing from the carburetor to the cylinders in the intake section of the manifold.

b. Replacement.

(1) **REMOVAL.** Disconnect the fuel line from the carburetor. Remove 2 nuts which hold the automatic choke to the manifold and lift the choke from the manifold (fig. 24). Take off the 2 nuts securing the carburetor to the manifold and remove the carburetor. Disconnect vacuum line from the manifold. Take out 2 bolts from the upper flange of the exhaust pipe. Remove the 12 brass nuts securing the manifold to the engine and remove the manifold.

(2) **INSTALLATION.** Reverse sequence of steps of removal procedure.

52. MOTOR MOUNTS.**a. Front Motor Mounts, Replacement.**

(1) **REMOVAL.** Place a jack under the flywheel housing to support the weight of the engine while the front mounts are removed. Remove 4 screws holding mount to flywheel housing. Remove 2 bolts securing the mount to the bracket on the hull and remove the mount and rubber pads. The same procedure applies to either the right or left side.

(2) **INSTALLATION.** Reverse sequence of steps of removal procedure.

b. Rear Motor Mounts, Replacement.

(1) **REMOVAL.** Attach a lifting sling to the engine, and with a hoist, support the weight of the engine while the rear mounts are being removed. Remove nut from the bolt and remove bolt and rubber biscuits from the cross member of the hull. The same procedure applies to either side.

(2) **INSTALLATION.** Reverse sequence of steps of removal procedure.

ENGINE

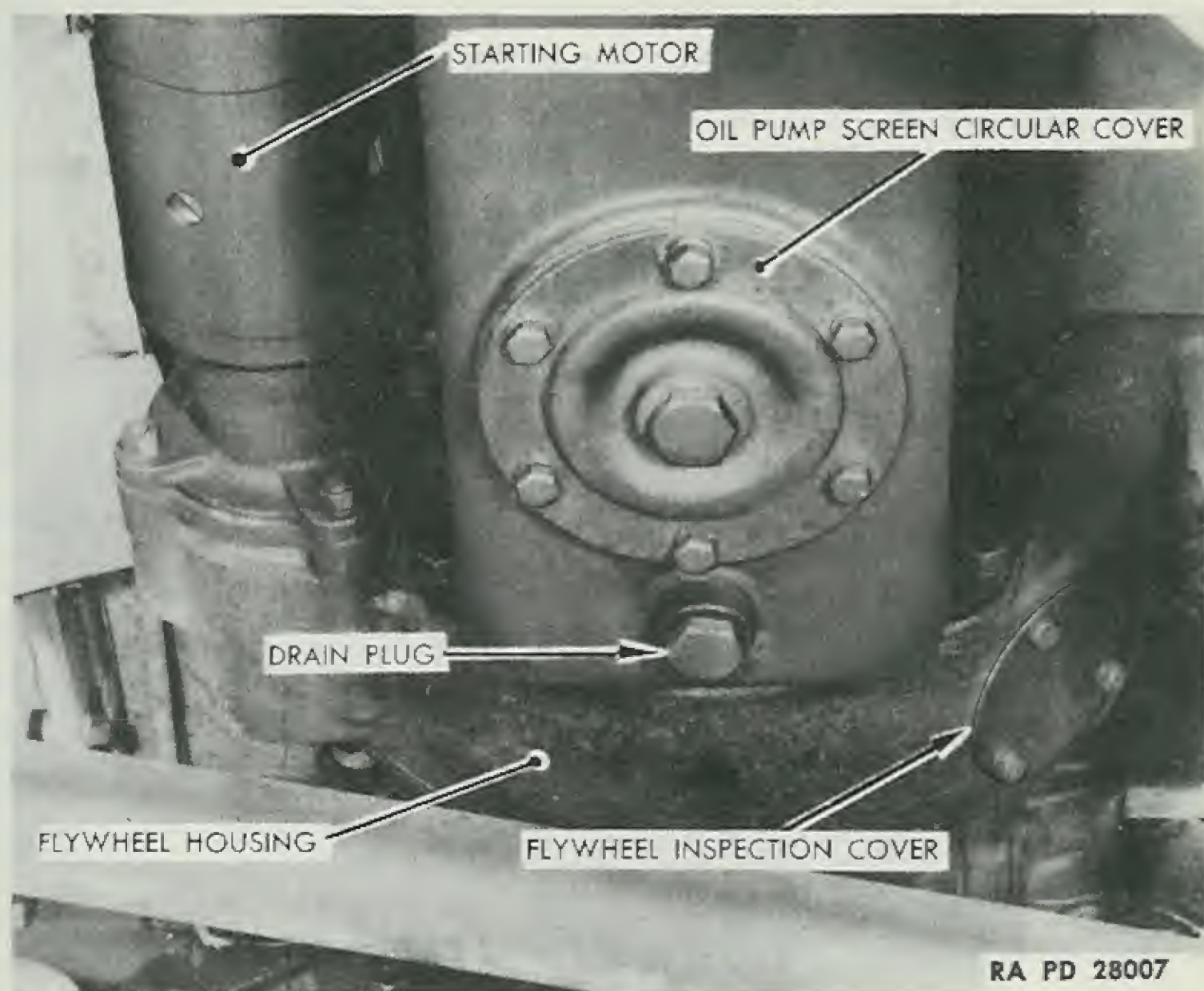
53. OIL PAN.

a. **Description.** The oil pan is accessible for removal with the engine in the vehicle.

b. Replacement.

(1) **REMOVAL.** Remove oil drain plug and drain oil (fig. 15). Take out 20 screws which hold the pan to the engine crankcase and 5 screws securing it to the flywheel housing and remove the pan.

(2) **INSTALLATION.** Reverse sequence of steps of removal procedure. **NOTE:** When replacing the oil pan, care must be exercised to get a tight joint at the corner or angle forward by the cylinder block and the flywheel housing. After all screws are started, draw up gradually and progressively on the vertical and horizontal screws alike. This will prevent undue strain on the pan and at the same time insure a tight joint.



RA PD 28007

Figure 15 — Engine Oil Pan Drain Plug, Screen Cover Plate and Starting Motor

LIGHT ARMORED CAR M8

54. OIL PUMP.

a. **Description.** At the center of the camshaft a spiral gear meshes with the oil pump drive gear. The pump is of the gear type and is readily removed for inspection or repairs while the oil pan is off the engine.

b. **Replacement.**

(1) **REMOVAL.** Remove oil pan (par. 53 b (1)). Remove 2 cap screws from the oil pump mounting flange, and remove the pump from the crankcase.

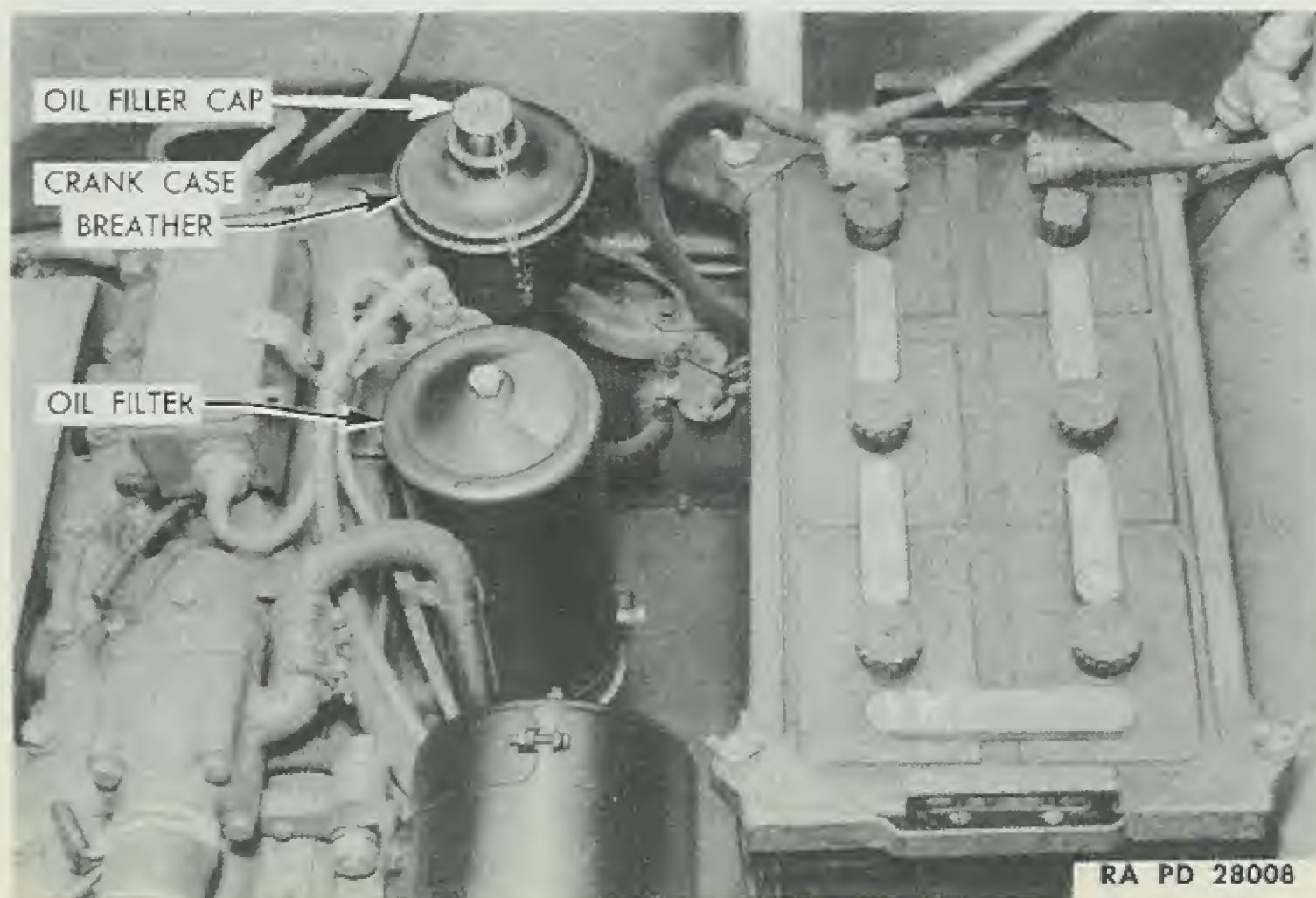
(2) **INSTALLATION.** Reverse sequence of steps in removal procedure.

c. **Oil Pump Screen.** The oil pump screen can readily be removed from the oil pan without the necessity of removal of the oil pan from the engine, as the screen is integral with a circular plate attached to the bottom of the pan with 6 screws (fig. 15).

(1) **REPLACEMENT OF OIL PUMP SCREEN.**

(a) **Removal.** Take out 6 screws securing the circular plate to the bottom of the oil pan and remove the plate and screen assembly (fig. 15).

(b) **Installation.** When replacing the screen, be sure the felt washer is slipped over the end of the pump suction pipe. This washer is to prevent unscreened oil from entering the oil pump at the point where the



RA PD 28008

Figure 16 — Oil Filter and Oil Filler Cap

ENGINE

suction pipe enters the screen. Use new gasket and attach the plate with screws and lock washers.

55. CYLINDER HEAD.

a. Description. The cylinder head is of the removable type, having the major part of the combustion space over the valves, and is completely water-jacketed. The construction of the head permits easy removal for cleaning carbon or grinding valves.

b. Replacement.

(1) **REMOVAL.** Drain water (par. 49 a (2)). Remove generator (par. 86 d). Take out 2 screws which hold the water thermostat housing and spark plug wire conduit to the cylinder head and remove the housing. The spark plug wires and conduit can now be lifted from the cylinder head. Disconnect wire from heat indicator (engine unit). Remove 26 screws which secure the cylinder head to the cylinder block, and remove the head.

(2) **INSTALLATION.** Reverse sequence of steps in removal procedure, using a new cylinder head gasket. Use a torsion wrench and tighten cylinder head screw to 52½ foot-pounds.

56. OIL FILTER (fig. 16).

a. Description. A Fram military standard oil filter is used. It is mounted on the right side of the engine. The base of the filter is its mounting bracket, and contains the inlet and outlet oil passages, which when installed match up with the oil passages in the crankcase. The filter element is contained in a cartridge and this cartridge should be changed at intervals specified in subparagraph b, following.

b. Maintenance. The instructions for servicing the filter are printed on decalcomania on the filter cover. These point out the filter element should be changed when the oil on the dip stick becomes dark. In general, it is recommended that the cartridge be changed each time the oil is changed. The instructions given on the filter cover for servicing are as follows.

“Remove the cover.

Install new element.

Remove drain plug.

Install new gasket.

Drain sludge.

Install cover.

Remove cartridge element.

Start engine and check for leaks.”

LIGHT ARMORED CAR M8

c. Replacement of Oil Filter Assembly.

(1) REMOVAL. Drain water (par. 49 a (2)). Loosen hose clamp on hose connecting water pump at filter base. Remove 4 screws which secure the filter base to the crankcase and remove the filter assembly.

(2) INSTALLATION. Reverse sequence of steps in the removal procedure, using a new gasket.

57. CRANKCASE BREATHER (fig. 16).

a. Description. The crankcase breather contains an air filtering element and is located on the right side of the engine incorporated with the oil filler pipe.

b. Maintenance. To remove the filter element for cleaning, take off oil filler cap; then take out the screw at the top center of the filter. Lift out filter element. The filter should be cleaned by washing with SOLVENT, dry-cleaning. Blow out with compressed air. When dry, dip in engine oil of seasonal grade. Replace filter element and oil filler cap.

58. EXHAUST SYSTEM.

a. The exhaust system consists of a combination exhaust and intake manifold; a muffler and an exhaust pipe. The manifold is described in paragraph 51. The muffler is located crosswise at the rear of the vehicle. The exhaust pipe is connected between the manifold and muffler and attached by means of flange couplings at the ends. Each section is readily removed from the vehicle without disturbing the other sections.

Section XIV

IGNITION SYSTEM

	Paragraph
General description and data.....	59
Ignition switch	60
Ignition coil	61
Distributor	62
Ignition timing	63
Spark plugs	64
High tension wires.....	65

59. GENERAL DESCRIPTION AND DATA.

a. **Description.** The ignition system consists of the battery (par. 88), ignition switch (par. 6 b (11)), distributor (par. 62), an ignition coil (par. 61), spark plugs (par. 64) and the necessary connecting wires.

b. Tabulated Data.

Rotation of distributor.....	Clockwise
Firing order (numbered from rear to front).....	1-5-3-6-2-4
Initial advance	2 deg of crankshaft
Maximum advance....	11½ deg of distributor at 1,600 rpm of distributor
Advance starts at.....	400 rpm of distributor
Breaker arm spring tension.....	17 to 20 oz
Breaker points spacing.....	0.020 in.
Ignition coil voltage (primary).....	12 volts
Spark plug spacing.....	0.025 in.

c. **Ignition Trouble Shooting.** All ignition troubles are reflected in the performance of the engine and are listed in the engine section under paragraph 47.

60. IGNITION SWITCH.

a. **Description.** The ignition switch is located on the instrument panel (fig. 5). With this switch in the "ON" position, the ignition circuit for the engine is complete (battery master switch (par. 6 c (11)) must be also on); and in the "OFF" position, the ignition circuit for the engine is open.

LIGHT ARMORED CAR M8

b. Replacement.

(1) REMOVAL. Turn off battery master switch. Remove instrument panel (par. 94 b (1)). Remove the 2 ignition wires, tagging them for later identification. Remove the 2 nuts and bolts that hold ignition switch and remove ignition switch from the panel.

(2) INSTALLATION. Reverse sequence of the steps of the removal procedure.

61. IGNITION COIL.

a. Description. An Electric Auto-Lite ignition coil is provided, mounted on the right-hand side of the engine (fig. 30). This is a conventional automotive-type ignition coil, except that this coil is designed for a 12-volt system and is provided with cooling fins, and is oil filled.

b. Replacement.

(1) REMOVAL. Unscrew plastic nut and pull out the high tension wire. Disconnect primary wires from the coil. Remove the 2 cap screws in the coil bracket and lift the coil from the engine.

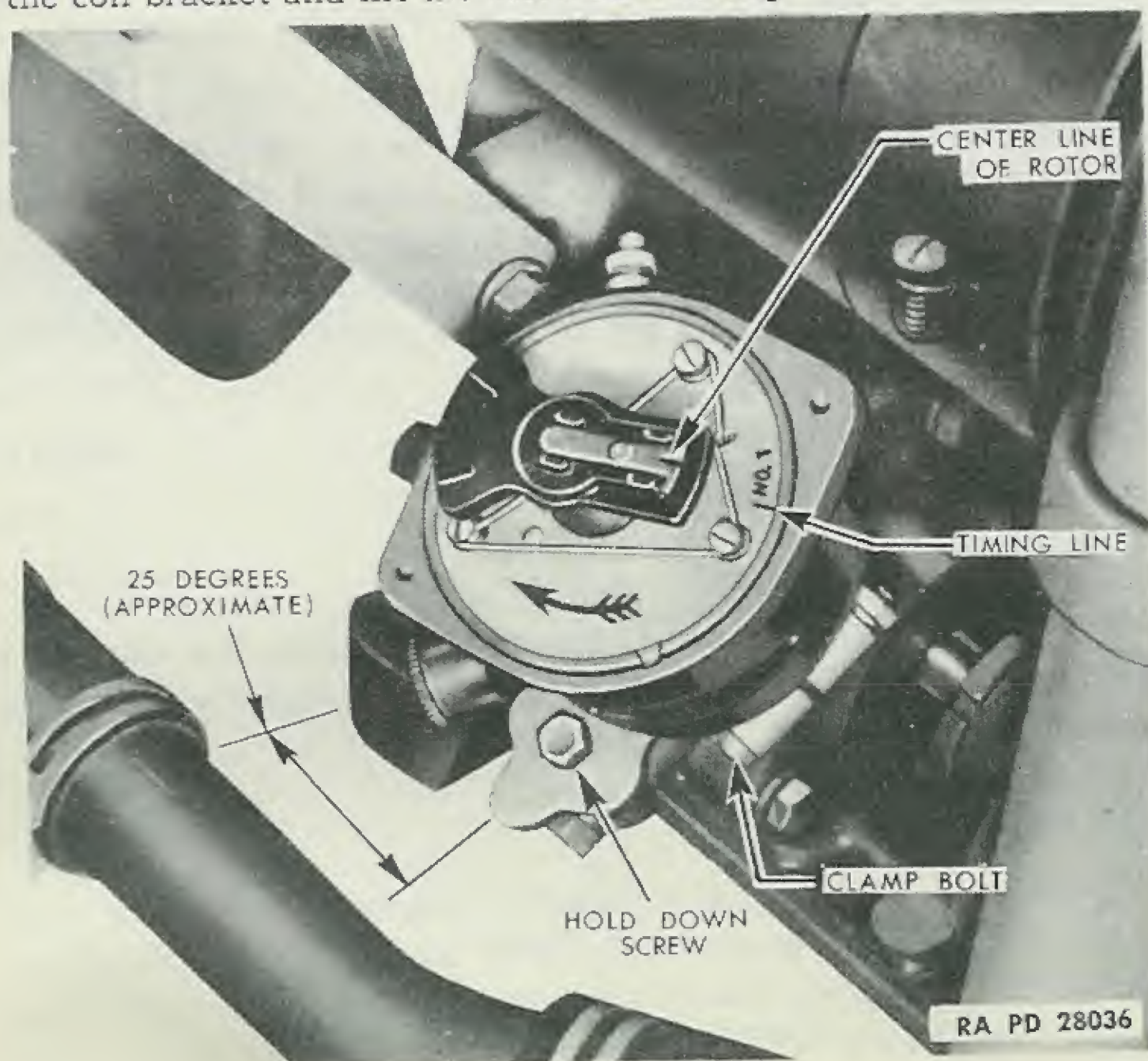
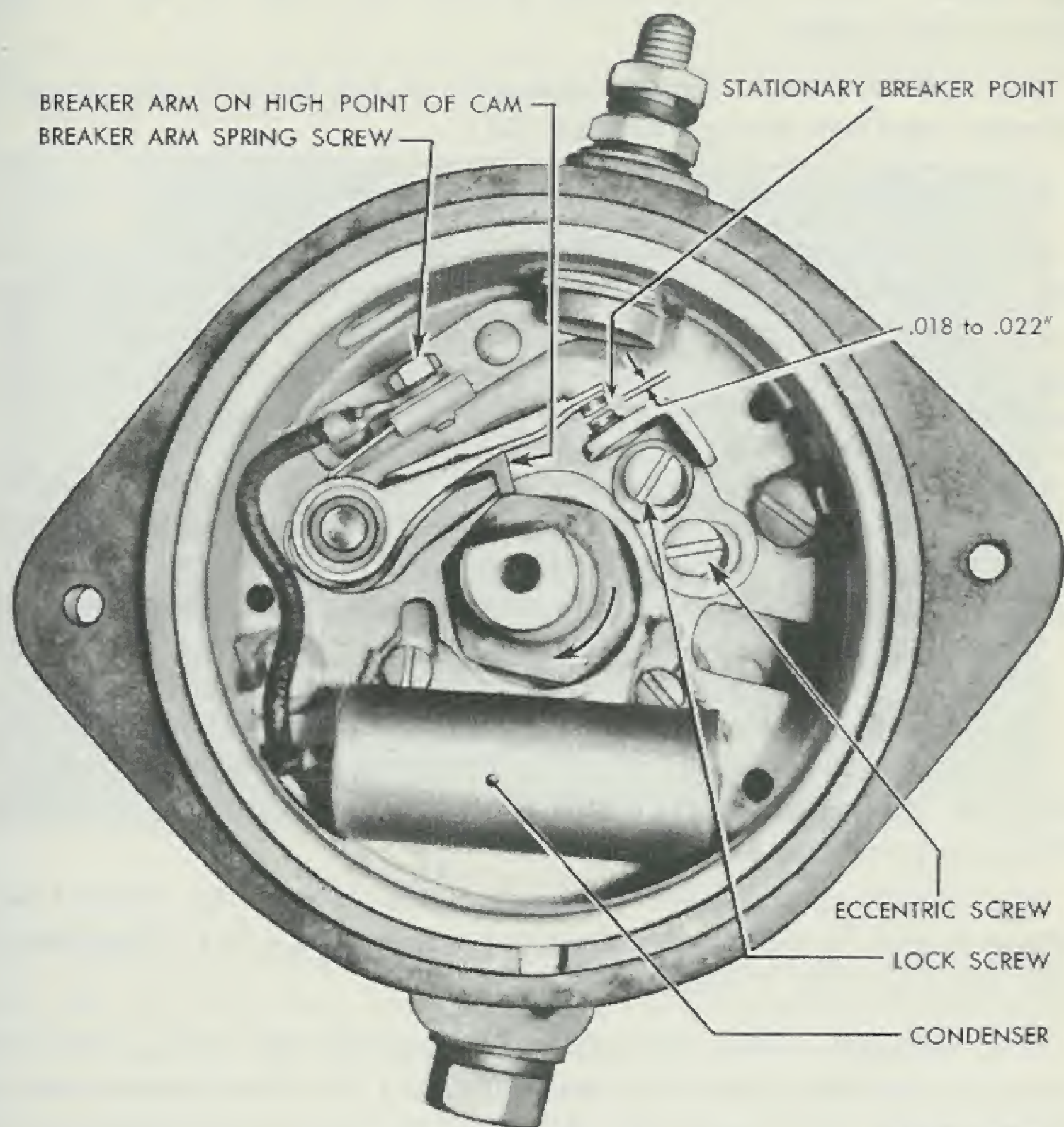


Figure 17 — Distributor with Cap Removed

IGNITION SYSTEM



RA PD 28009

Figure 18 — Distributor Points

(2) **INSTALLATION.** Reverse sequence of the steps of the removal procedure.

62. DISTRIBUTOR.

a. **Description.** The engine uses a 6-cylinder distributor (Electric Auto-Lite) mounted on the right-hand side of the engine at the rear (fig. 17). See paragraph 59 b for tabulated data.

b. Replacement.

(1) **REMOVAL.** Open the engine compartment doors to gain access to distributor. Remove nut and lift off primary wire running to ignition coil. Remove locking wire and cap screws from distributor cap and lift off

LIGHT ARMORED CAR M8

cap. Remove hold-down screw and ground wire (fig. 17) and lift distributor from engine.

(2) **INSTALLATION.** Reverse sequence of the steps of the removal procedure and time the ignition (par. 63).

c. Check, Adjust or Replace Breaker Points.

(1) **PRELIMINARY WORK.** Open the engine compartment doors to gain access to the distributor. Remove the locking wire and the 2 cap screws from the distributor cap and remove the cap. Remove the rotor (fig. 17) by pulling straight up. Remove the locking wire and 3 cap screws from the internal cover plate (fig. 17) and remove the plate.

(2) **INSPECTION OF THE BREAKER POINTS** (fig. 18). Inspect the condition of the breaker points; if the points are burnt or pitted, they should be replaced (par. 62 c (3)). Should the points be in satisfactory condition, reset the points as outlined in paragraph 62 c (4).

(3) **REPLACEMENT OF THE BREAKER POINTS.**

(a) *Removal.* Remove the screw which holds the breaker arm spring to its bracket (fig. 18) and lift off the breaker arm. Remove the locking wire from the lock screw, remove the lock screw and lift out the breaker stationary point (fig. 18).

(b) *Installation.* Reverse sequence of the steps of the removal procedure. Adjust the points as outlined in paragraph 62 c (4). Check timing (par. 63) and reset if necessary.

(4) **BREAKER POINT ADJUSTMENT.** Remove the locking wire and loosen the breaker point lock screw (fig. 18). Set the breaker arm on the high point of the cam (fig. 18). Turn the eccentric adjusting screw (fig. 18) to the right or left, increasing or decreasing the gap to 0.020 inch. Tighten the lock screw and recheck the gap. Install the internal cover plate (fig. 17) and the 3 cap screws, locking them with locking wire. Place the distributor rotor on the shaft. Check the timing (par. 63) and reset if necessary.

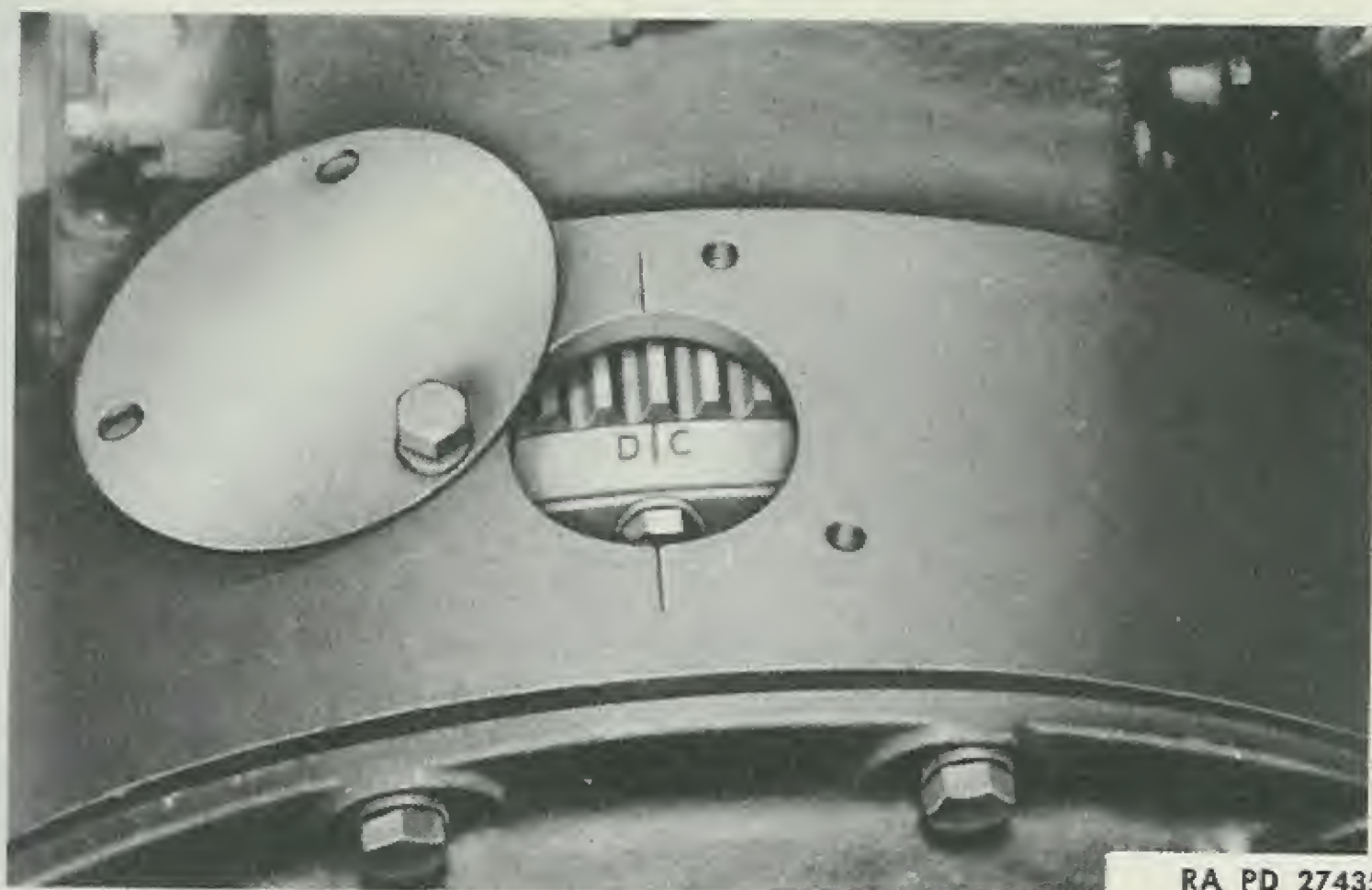
63. IGNITION TIMING.

a. **Preliminary Work.** Open engine compartment doors and remove the 6 spark plugs to relieve the compression. (Be careful that nothing drops in the spark plug holes.) Remove 2 cap screws from the flywheel inspection cover (fig. 15) and swing the cover out of the way.

b. **Set No. 1 Piston on Top Dead Center of Compression Stroke.** Place the gearshift lever (fig. 7) in neutral position. Place the compression gage or equivalent in No. 1 spark plug hole. Use the fan to

IGNITION SYSTEM

turn the engine until No. 1 piston is coming up on the compression stroke. Continue to turn the engine until the "DC" (dead center) mark on the flywheel lines up with the index mark on the flywheel housing (fig. 19). This will place No. 1 piston on top dead center.



RA PD 27435

Figure 19 – Timing Marks on Flywheel

c. **Setting Distributor in Place.** Remove the 2 cap screws which hold the distributor cap and remove the cap. Remove the distributor hold-down screw (fig. 17) and lift out the distributor. Place the center line of the distributor rotor over the timing line marked No. 1 on the internal cover plate (fig. 17). Maintain the hold-down arm approximately 25 degrees counterclockwise from grease cup (fig. 17) and remove hold-down cap screw. Insert distributor in the mounting hole and "feel out" gear teeth mesh until hold-down arm is over the rear hole in the mounting bracket. If necessary, let the rotor shift a little from the No. 1 marking. Insert and tighten the hold-down screw. Loosen the clamp bolt on the hold-down arm. Rotate the distributor body until the center line of the rotor again lines up with No. 1 mark on the plate. Install the distributor cap and all wires and turn ignition on.

d. **Setting the Timing.** Hold the spark plug end of No. 1 spark plug wire $\frac{1}{8}$ inch away from the cylinder. Turn the engine over until timing mark on the flywheel is $\frac{1}{4}$ inch in advance of the index mark. Rotate the distributor to the point where the spark occurs between No. 1 spark plug wire and the cylinder head, and tighten the clamp bolt. The engine will then be timed 2 crankshaft degrees advanced. Reinstall spark plugs.

LIGHT ARMORED CAR M8

64. SPARK PLUGS.

a. The spark plugs are Champion J-10 automotive type. The spark plugs can be effectively cleaned only with a sand-blast type cleaner. After cleaning, always reset the gap. The correct gap adjustment is 0.025 inch. Never bend the center electrode when establishing the gap. Always use the correct wrench when removing or installing spark plugs to avoid breaking the porcelains. Keep the exterior surfaces of the porcelains clean to avoid shorting in damp weather.

65. HIGH TENSION WIRES.

a. The spark plug and coil wires are high tension automotive type wires. To replace the spark plug wires, disconnect the wires from spark plugs, unscrew plastic nuts on distributor cap and pull wires out of the cap and then from the conduit on the engine.

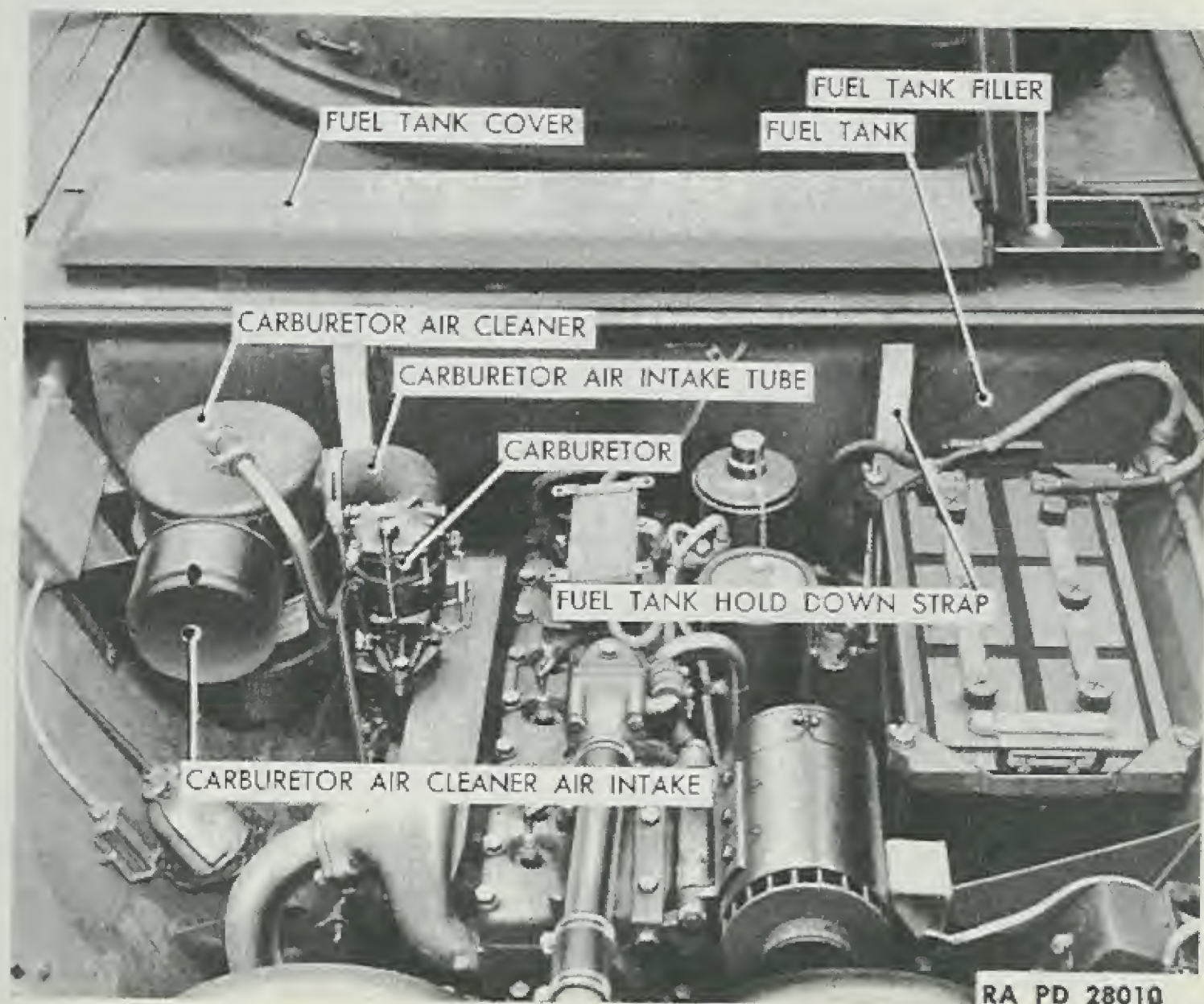
Section XV

FUEL SYSTEM

	Paragraph
General description and data	66
Maintenance and inspection	67
Carburetor	68
Air cleaners	69
Throttle control	70
Automatic choke	71
Fuel pump	72
Fuel filter	73
Fuel tank	74
Priming pump and fuel lines.....	75

66. GENERAL DESCRIPTION AND DATA.

a. The fuel system consists of a 59-gallon tank located in the forward end of the engine compartment, a fuel filter (par. 73), fuel pump (par. 72), carburetor (par. 68), automatic choke (par. 71), a hydraulically



RA PD 28010

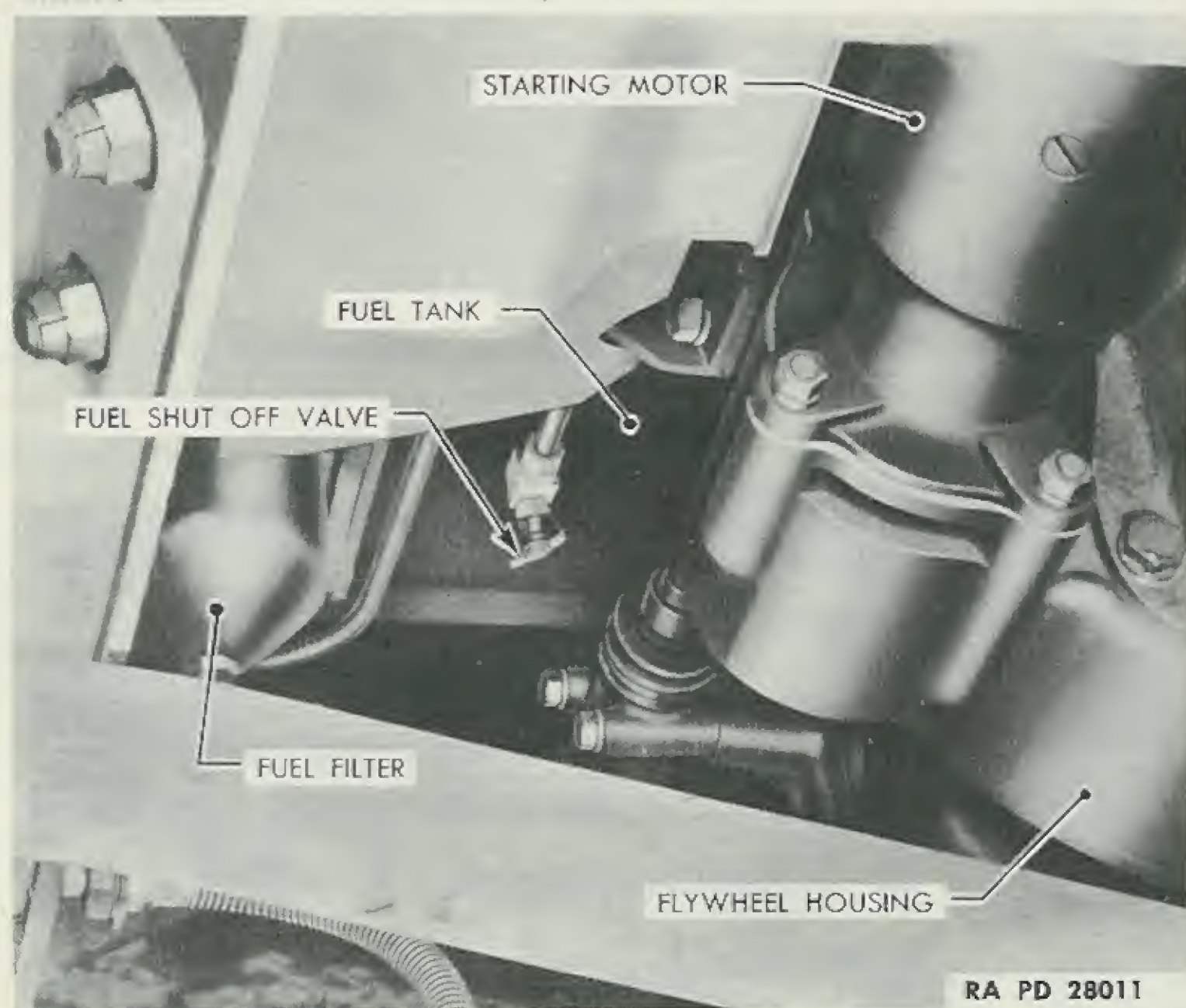
Figure 20 — Fuel Tank, Carburetor and Carburetor Air Cleaner

LIGHT ARMORED CAR M8

operated foot throttle control (par. 70) and the necessary connecting lines.

67. MAINTENANCE AND INSPECTION.

a. The fuel tank should be checked frequently for leaks, water, rust and other sediment. If, when draining the fuel filter as outlined in paragraph 73 b an excessive amount of water is noted, open the fuel shutoff valve (fig. 21) at the bottom of the tank to allow water and sediment to drain from the tank also.



RA PD 28011

Figure 21 — Fuel Filter and Fuel Shutoff Valve from Below

68. CARBURETOR (fig. 22).

a. **Description.** A Zenith model 29W-12 carburetor is used. The carburetor is a single barrel downdraft unit. It has 2 floats connected by one lever and operating one needle valve.

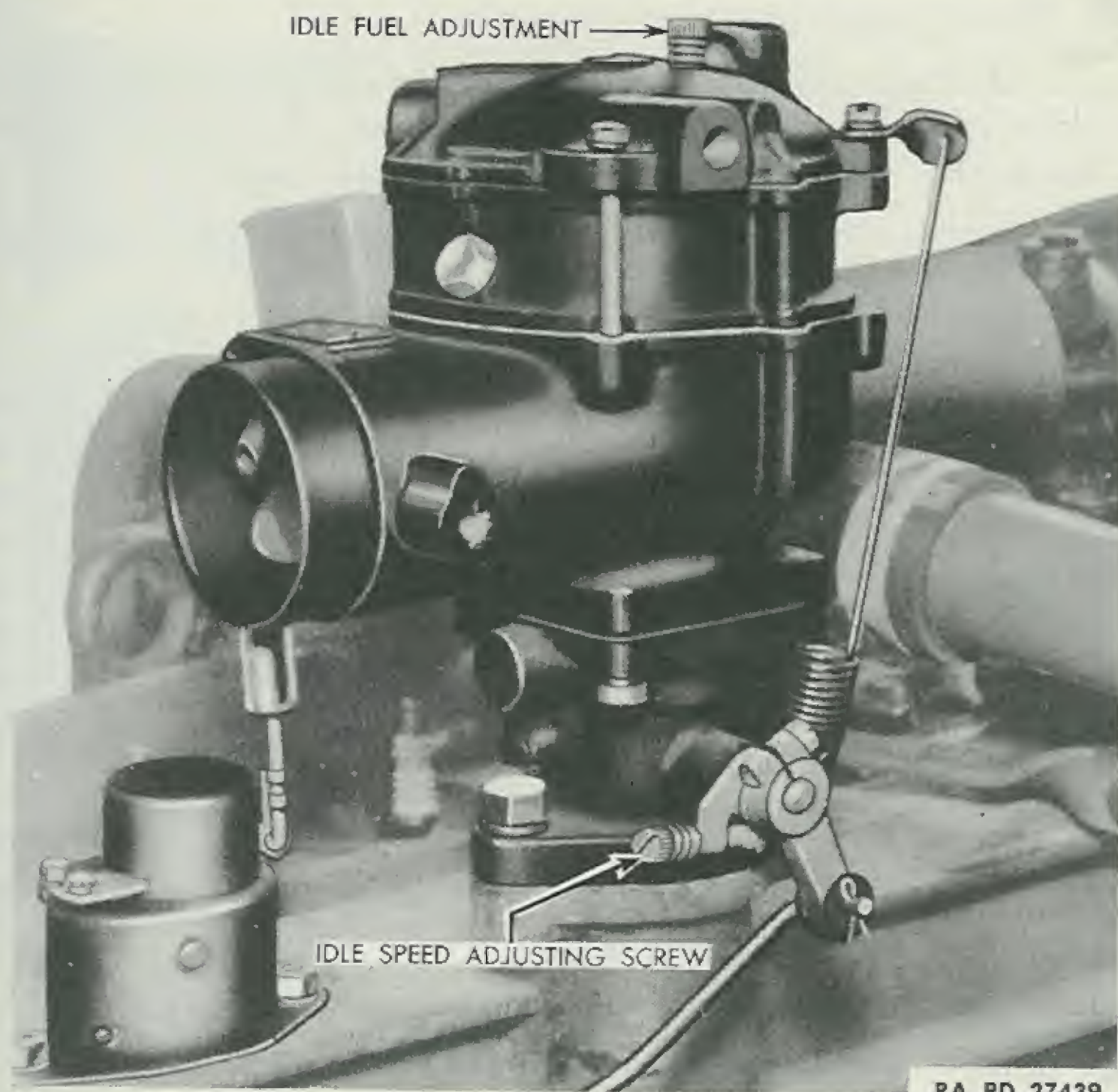
b. **Idling Adjustment.** The idling fuel adjustment screw is located on the carburetor cover as shown in figure 22. The idling speed adjustment likewise is shown in figure 22. Make initial idling fuel adjustments with

FUEL SYSTEM

the engine stopped. Seat the idling fuel adjusting screw lightly; then turn out $\frac{5}{8}$ turn. These carburetors are not uniform and this procedure will provide only an average adjustment. Start the engine and allow to idle until engine is warmed up. After engine has warmed up, set idling speed at approximately 400 revolutions per minute; then manipulate the idling fuel adjustment screw from $\frac{1}{2}$ to $1\frac{1}{4}$ turns; open until the "roll" is out of the engine. Reset the idling speed to 500 revolutions per minute. If the engine still does not operate properly, notify organization maintenance personnel.

c. **Removal.** Remove carburetor air intake tube (fig. 20). Disconnect the fuel feed line at the carburetor. Disconnect the automatic choke control rod. Disconnect the throttle rod at the carburetor. Remove 2 carburetor base nuts that hold the carburetor to the intake manifold and remove the carburetor.

d. **Installation.** Reverse sequence of steps in the removal procedure.



RA PD 27439

Figure 22 — Carburetor

LIGHT ARMORED CAR M8

69. AIR CLEANERS (fig. 20).

a. **Description.** An air cleaner of the oil bath type is located at the left side of the engine compartment mounted on the side of the hull. The intake to the oil bath section contains a screen type air cleaner which is detachable and is serviced separately.

b. **Maintenance.** See section VI.

c. **Servicing.** Release the 2 hold-down clips and remove the baffle and cap assembly. Refill the cup to proper level with oil specified (sec. VI). Care should be taken not to fill the cup over the level mark. Place bottom of cup on air cleaner and fasten with the 2 hold-down clips. To clean the air intake filter element, remove the air intake from the oil bath section, disassemble and wash all parts with SOLVENT, dry-cleaning. Dry and blow out with compressed air in reverse to normal air travel and dip in engine oil. Reassemble filter and attach to the oil bath section.

d. **Replacement.**

(1) **REMOVAL.** Disconnect outlet connection to carburetor and connection to vacuum cylinder. Remove screws from the mounting bracket and remove the assembly from the engine compartment.

(2) **INSTALLATION.** Reverse sequence of steps of removal procedure.

70. THROTTLE CONTROL.

a. **Description.** The carburetor throttle plate is controlled by the foot throttle pedal on the floor of the driver's compartment. The movement of the driver's foot actuates the fluid in a *master* hydraulic cylinder directly in front of the pedal. A hydraulic fluid *reservoir* located in front of the assistant driver supplies fluid to the master cylinder. The movement of the fluid in the master cylinder is transmitted through *the lines* to a hydraulic slave cylinder located at the left-hand side of the engine on the flywheel housing (fig. 34). This movement is then transmitted to the carburetor throttle shaft lever by direct linkage.

b. **Adjustment.** The arm on the carburetor throttle valve shaft must be adjusted so as to get full opening and closing of the throttle valves when the foot throttle pedal is depressed and released.

c. **Master Cylinder.**

(1) **REPLACEMENT.**

(a) **Removal.** Remove clevis pin from rod running from pedal to the master cylinder. Disconnect fluid lines from the master cylinder. Remove

FUEL SYSTEM

4 screws holding the master cylinder to the mounting bracket and remove the master cylinder.

(b) *Installation.* Reverse sequence of steps of removal procedure. Bleed throttle system as outlined in paragraph 70 g.

d. Slave Cylinder.

(1) REPLACEMENT.

(a) *Removal.* Open engine compartment doors. Disconnect the fluid line from the slave cylinder. Disconnect control rod and spring. Remove 3 nuts which hold the slave cylinder to the mounting bracket and remove the slave cylinder.

(b) *Installation.* Reverse sequence of steps of removal procedure. Bleed the throttle control system as outlined in paragraph 70 g.

e. Hydraulic Fluid Reservoir (fig. 23).

(1) REPLACEMENT.

(a) *Removal.* Remove plug at bottom of the reservoir and drain the



RA PD 28012

Figure 23 — Foot Throttle, Hydraulic Reservoir and Priming Pump

LIGHT ARMORED CAR M8

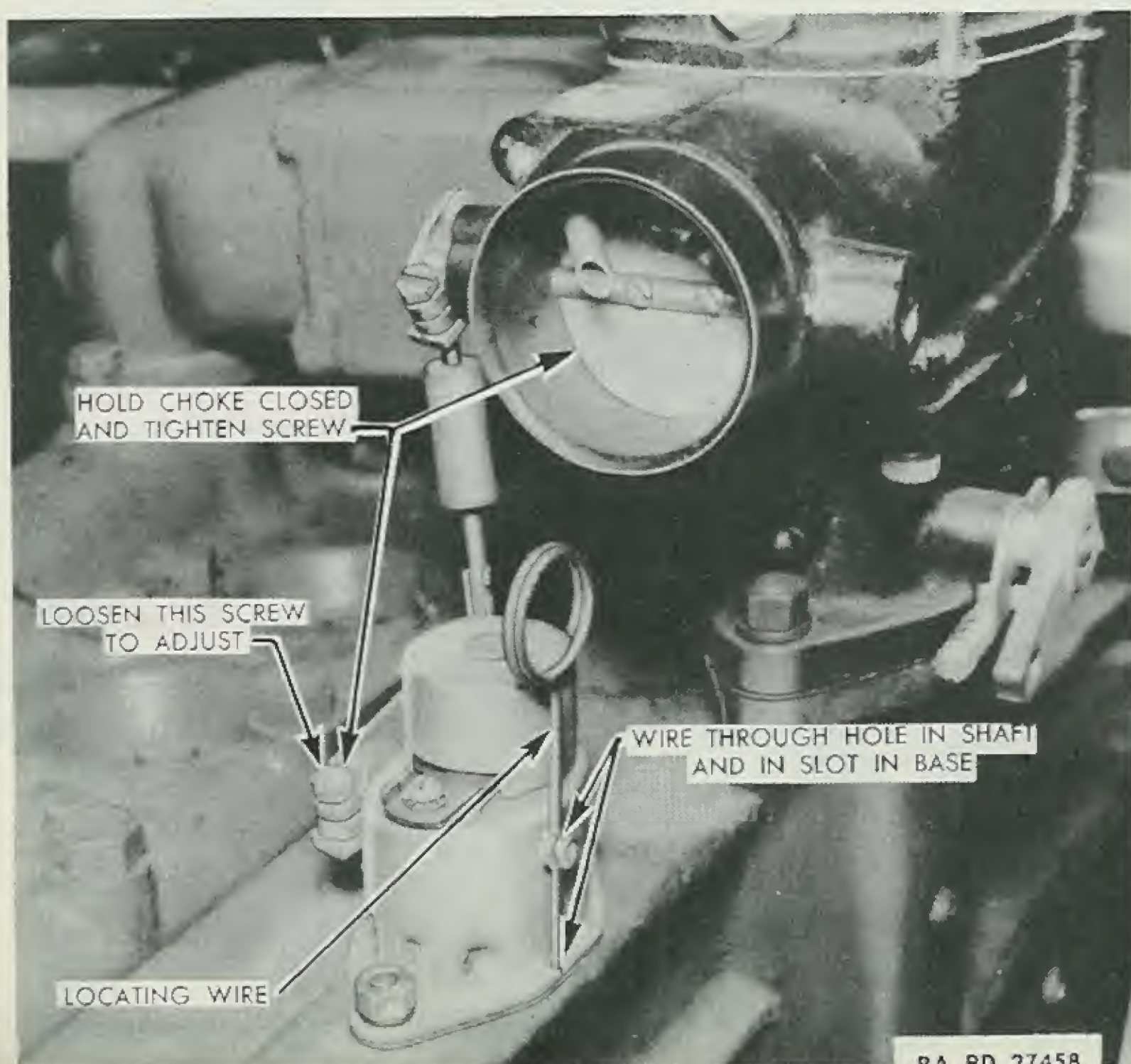
fluid. Disconnect the fluid line from the reservoir. Remove the 2 screws from the mounting bracket and remove the reservoir.

(b) *Installation.* Reverse sequence of steps of removal procedure. Bleed the throttle control system as outlined in paragraph 70 g.

f. Hydraulic Lines.

(1) **REPLACEMENT.** The hydraulic lines are equipped with connections that permit the easy removal and replacement of any section of the line. When installing new lines, make sure the contour of the lines is the same as the original contour of the line being replaced. Bleed the system when any of the lines are replaced (par. 70 g).

g. Bleeding Throttle Control System. Remove the filler plug at fluid reservoir (fig. 23) and fill the reservoir with FLUID, brake, hydraulic. Remove the dust cap from the bleeder valve on the slave cylinder located in the engine compartment. Attach a bleeder tube to the bleeder valve. Put the other end of the bleeder tube in a clear glass jar containing some



RA PD 27458

Figure 24 — Automatic Choke

FUEL SYSTEM

hydraulic fluid. The end of the tube should be below the surface of the fluid (fig. 47). Unscrew the bleeder valve about $\frac{3}{4}$ of a turn. Pump foot accelerator slowly, allowing time between strokes to allow fluid to feed by gravity from the reservoir to the cylinder. Continue to pump the accelerator pedal until no more bubbles come out (fig. 47). When, with each stroke of the pedal, only fluid comes out, close the bleeder valve and replace dust cap. Refill fluid reservoir (fig. 23).

71. AUTOMATIC CHOKE (fig. 24).

a. **Description.** The carburetor is provided with an automatic choke control which closes the choke plate in the carburetor for cold starting and opens automatically as the engine warms up.

b. **Adjustment.** Loosen the screw holding the control lever to the shaft (fig. 24). Install a straight piece of wire through the hole in the shaft, turning the shaft so that the other end of this locating wire is in the slot in the base of the automatic choke (fig. 24). Set the lever so that the choke plate is completely closed and tighten the lever to the shaft. Remove the locating wire.

c. Replacement.

(1) **REMOVAL.** Disconnect thermostat control wire. Disconnect choke control lever rod. Remove 2 mounting nuts which hold the automatic choke to the exhaust manifold and remove the choke.

(2) **INSTALLATION.** Reverse sequence of steps of removal procedure, and adjust as outlined in paragraph 70 b.

72. FUEL PUMP.

a. **Description.** The fuel pump is mounted on the left side of the crankcase. Power is applied to the rocker arm by an eccentric on the camshaft. The pump maintains a pressure of 5 pounds to the carburetor.

b. **Maintenance.** At the 1,000-mile inspection, check for leakage at connections and fittings. Clean the fuel pump filter bowl and tighten the diaphragm screws and fuel line connections.

c. **Repairs.** Minor repairs, consisting of replacing gaskets, cleaning fuel pump filter bowl and tightening all screws may be made by the using arms. For other repairs, notify ordnance maintenance personnel.

d. Replacement.

(1) **REMOVAL.** Close fuel shutoff valve (fig. 21). Disconnect fuel line from pump. Remove the 2 screws holding pump to crankcase and remove the pump.

LIGHT ARMORED CAR M8

(2) **INSTALLATION.** Reverse sequence of steps in removal procedure, making certain the gasket is in good condition and in place.

73. FUEL FILTER (fig. 21).

a. **Description.** The fuel filter consists of a stack-type disk element and a metal filter bowl located at the bottom, left side of the fuel tank (fig. 21). The filtering element consists of a large number of filter disks (0.020 inch thick) stacked and squeezed together.

b. **Draining.** To drain the filter, close the fuel shutoff valve between the filter and the tank (fig. 21). Remove the drain plug at the bottom of the filter bowl to remove accumulated dirt and water. If excessive water is noted, drain the fuel also (par 67 a).

c. **Servicing.** Remove the center stud at the top of the filter. Clean the bowl and wash the filter element in fuel oil, kerosene or SOLVENT, dry-cleaning. Care should be taken to prevent damage to disks. Do not scrape or scrub the disks. Do not attempt to disassemble filter element; replace element if it cannot be cleaned satisfactorily. Before replacing, inspect filter bowl gasket and replace if necessary.

d. **Replacement.**

(1) **REMOVAL.** Close fuel tank shutoff valve (fig. 21). Disconnect fuel lines. Remove the 2 cap screws which hold filter to the fuel tank mounting bracket and remove the fuel filter.

(2) **INSTALLATION.** Install by reversing the steps of the removal procedure.

74. FUEL TANK (fig. 20).

a. **Replacement.**

(1) **REMOVAL.** Remove battery (par. 88 d). Take out the screws securing the battery bracket to the hull and remove the bracket. Remove carburetor air cleaner (par. 69 d (1)). Take out 8 screws from the cover over the fuel tank and remove the cover (fig. 20). Remove plug from bottom of fuel filter (fig. 21) and drain fuel from tank. Disconnect fuel line from bottom of tank. Take out 2 screws securing the fuel tank hold-down bands (fig. 20) to the bulkhead; then unhook the bands from the cross channel at the bottom. Lift the fuel tank from the vehicle.

(2) **INSTALLATION.** Reverse sequence of steps of removal procedure.

FUEL SYSTEM

75. PRIMING PUMP AND FUEL LINES (fig. 23).

a. **Description.** The description of the priming pump and its use is described in paragraph 6 b (10). The fuel lines consist of a line from the fuel tank to the fuel filter, from fuel filter to the fuel pump, a line from the pump to the carburetor, and the lines from the priming pump to engine compartment. These lines are of standard tubing, equipped with fittings which make any of the lines readily removable. When installing new lines, make sure the contour of the lines are the same as the original contour of the lines replaced. Tighten fittings firmly.

LIGHT ARMORED CAR M8

Section XVI

COOLING SYSTEM

	Paragraph
General description and data.....	76
Antifreeze	77
Radiator	78
Water pump	79
Fans	80
Fan belts	81
Thermostat	82
Hose	83

76. GENERAL DESCRIPTION AND DATA.

a. **Description.** The engine is cooled by water circulated through the engine block and radiator by a centrifugal pump (par. 79). The water in the radiator is cooled by 2 pusher type fans as shown in figure 25.

b. **Inhibiter.** To control rusting and corrosion in the cooling system, a soluble oil inhibitor must be used. It is important when the cooling system is refilled with fresh water after draining, especially when anti-freeze is not being used, that a soluble oil inhibitor be added to the water.

c. **Capacity.** The capacity of the cooling system is 23 quarts.

d. **Drains.** The cooling system is drained by a drain cock in the bottom of the radiator on the right side. A drain cock is provided for draining the engine block at the right front of the engine near the flywheel housing; however, the cooling system will drain completely from the radiator drain cock.

77. ANTIFREEZE.

a. High boiling point permanent antifreeze solutions or alcohols are satisfactory as antifreeze solutions. However, an inhibitor must be used, preferably as part of the antifreeze.

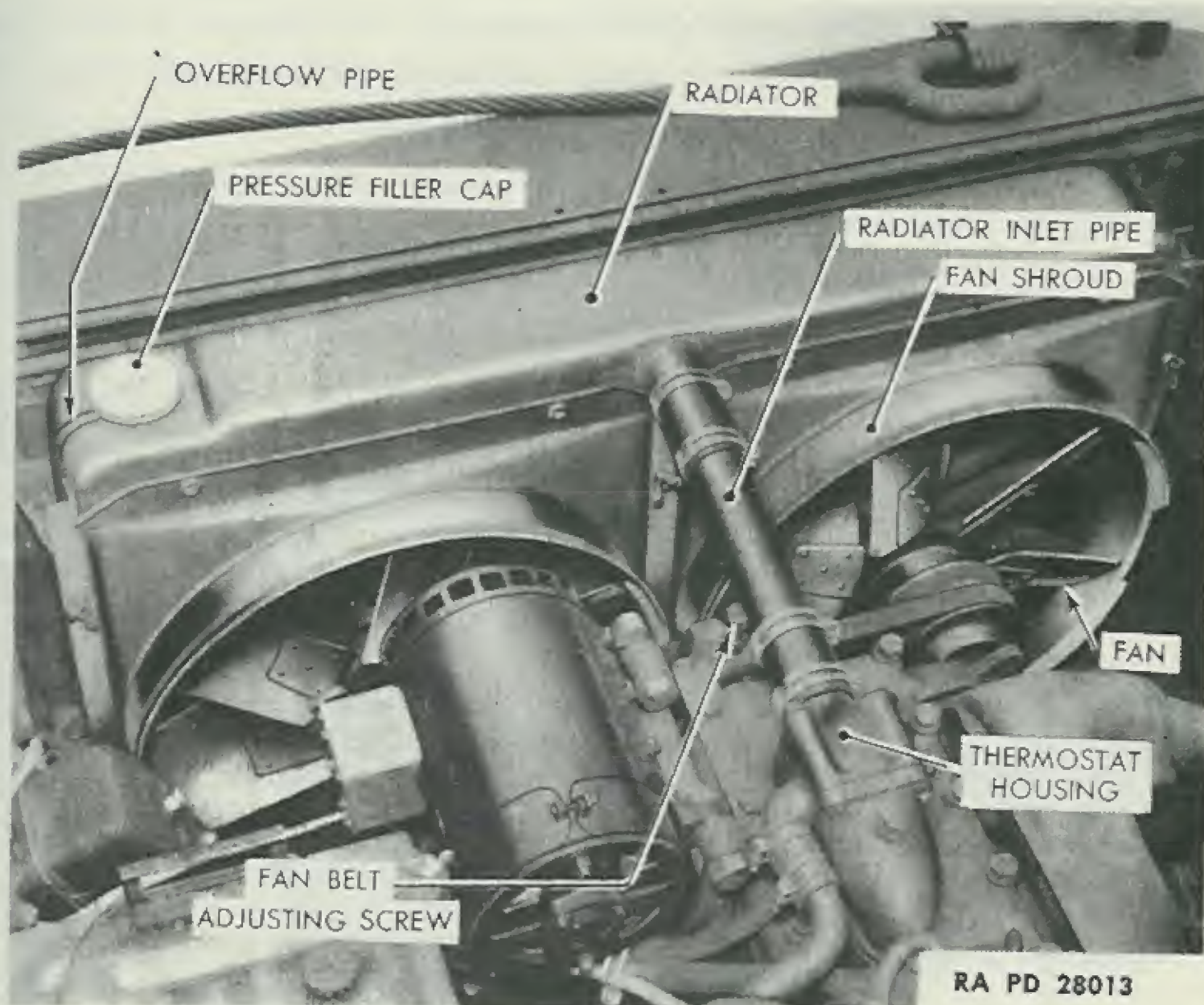
78. RADIATOR (fig. 25).

a. **Description.** The radiator is of the cross-flow-fin-and-tube type, using flat horizontal tubes. The hot water flows through the tubes to which are attached thin vertical copper fins. The radiator filler cap

COOLING SYSTEM

(fig. 25) is of the pressure type which permits the pressure to build up in the cooling system. This results in raising the boiling point of the water, thus reducing loss of water or antifreeze.

b. Maintenance. Always use clean water, preferably rain or soft water. Do not put cold water into the system when the engine is hot. The radiator and cooling system should be drained, flushed and refilled with clean water and inhibitor (par. 76 b) at least twice a year.



RA PD 28013

Figure 25 — Radiator and Fans

c. Replacement of Radiator.

(1) **REMOVAL.** Drain radiator (par. 76 d). Remove engine compartment doors (par. 49 a (1)). Remove the bolt and springs from the upper support bracket on each side of the radiator. Take out the cap screws from the lower bracket on each side of the radiator. Remove the cap screws from the fan shrouds and disconnect the shrouds from the radiator. Loosen the hose clamps from the upper and lower hose connection. Disconnect hose from radiator and lift radiator from vehicle.

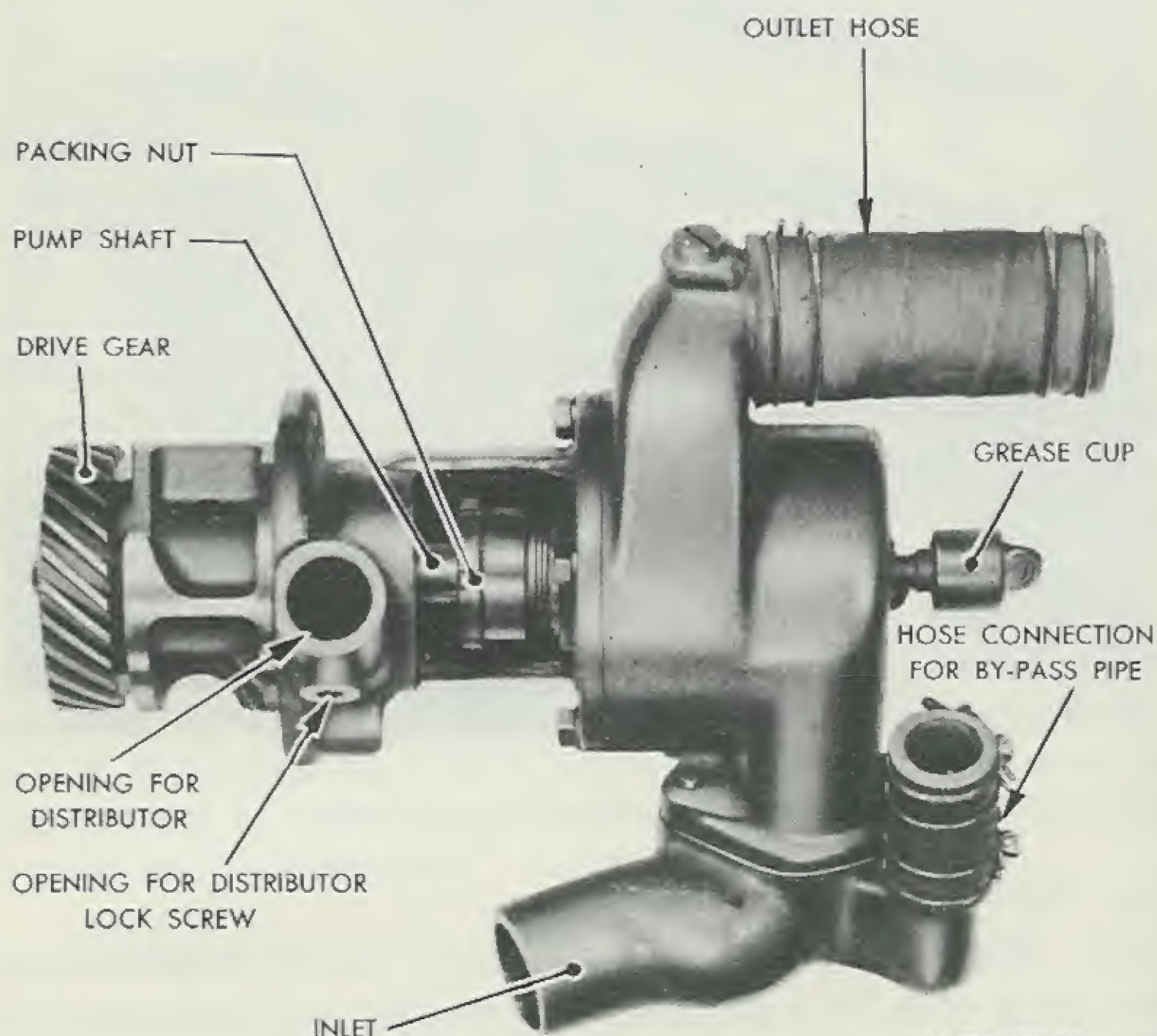
(2) **INSTALLATION.** Reverse the sequence of the steps in the removal procedure.

LIGHT ARMORED CAR M8

79. WATER PUMP (fig. 26).

a. **Description.** The water pump is a centrifugal type, located at right rear of the engine and is gear-driven from the crankshaft through an idler gear.

b. **Water Pump Packing.** The packing nut (fig. 26) should not be tightened too tight. Very little pressure on the packing is required. When tightening the packing nut to stop water leakage, use very little force; if leak does not stop, the pump packing should be replaced. A split-ring type packing is used which is easily replaced without removing the pump from the engine.



RA PD 28014

Figure 26 — Water Pump

(1) **REPLACEMENT OF PACKING.** Back off the packing nut completely and pull the packing out of the packing gland. Place new packing around the shaft and insert in the packing gland. Tighten packing nut lightly and run the engine. Very little additional tightening should be required.

COOLING SYSTEM

c. Replacement of Water Pump.

(1) **REMOVAL.** Drain the cooling system (par. 76 d). Raise engine compartment right-hand door. Remove the battery (par. 88 d). Loosen the hose connections at each end of the pipe running from the water pump to the thermostat housing on top of the engine, and remove the pipe. Loosen hose connections at inlet and outlet of the water pump. Remove the 4 cap screws which hold the oil filter bracket to the engine, also the 2 oil pipe connections from the filter. Remove the oil filter assembly. Remove the lock screw which holds distributor to the water pump housing (fig. 26). Remove the distributor cap and note position of rotor so that it may be replaced in the same position. Remove the generator (par. 86 d) and the 5 cap screws which hold the generator bracket to the engine. Remove the bracket. Remove the 3 cap screws which hold the water pump to the engine. Remove the water pump (fig. 26).

(2) **INSTALLATION.** Reverse the sequence of steps in the removal procedure except, that if the engine has turned over, it will be necessary to retune the distributor (par. 63).

80. FANS (fig. 25).

a. **Description.** Two 22-inch diameter 6-blade pusher type fans are used (fig. 25). They are mounted in front of the radiator. The fans draw air through the openings in the engine compartment doors and force the air out through the radiator and air baffles back of the radiator. Each fan is driven by a V-type belt from the crankshaft pulley.

b. Replacement.

(1) **REMOVAL.** To remove fans, disconnect fan shrouds from radiator (par 78 c (1)). Loosen fan belt adjustment (par. 81 b). Remove fan belts. Loosen generator belt adjustment (par. 86 c). Remove generator belt. Remove bolts which hold the bracket supporting the 2 fans. Remove the support bracket and fans with fan shrouds.

(2) **INSTALLATION.** Reverse sequence of steps in the removal procedure.

81. FAN BELTS (fig. 27).

a. **Description.** The fan belts are of the V-type and drive the fans from a double pulley on the crankshaft.

b. **Adjustment.** Both belts are adjusted at the same time by moving the bracket which carries the fans up or down. To adjust the bracket, loosen the fan belt adjustment lock nut (fig. 27). Loosen adjusting screw

LIGHT ARMORED CAR M8

lock nut (fig. 27). Turn the screw down to tighten, or up to loosen the belts. The fan belt adjustment is correct when a movement of 1 inch (figs. 27) is possible midway between the pulleys. The fans are a fairly close fit in their shrouds and it may be necessary to adjust the shrouds up or down to provide clearance. It will be necessary to adjust generator belt also (par. 86 c) as the fan belt adjustment changes the generator belt adjustment.

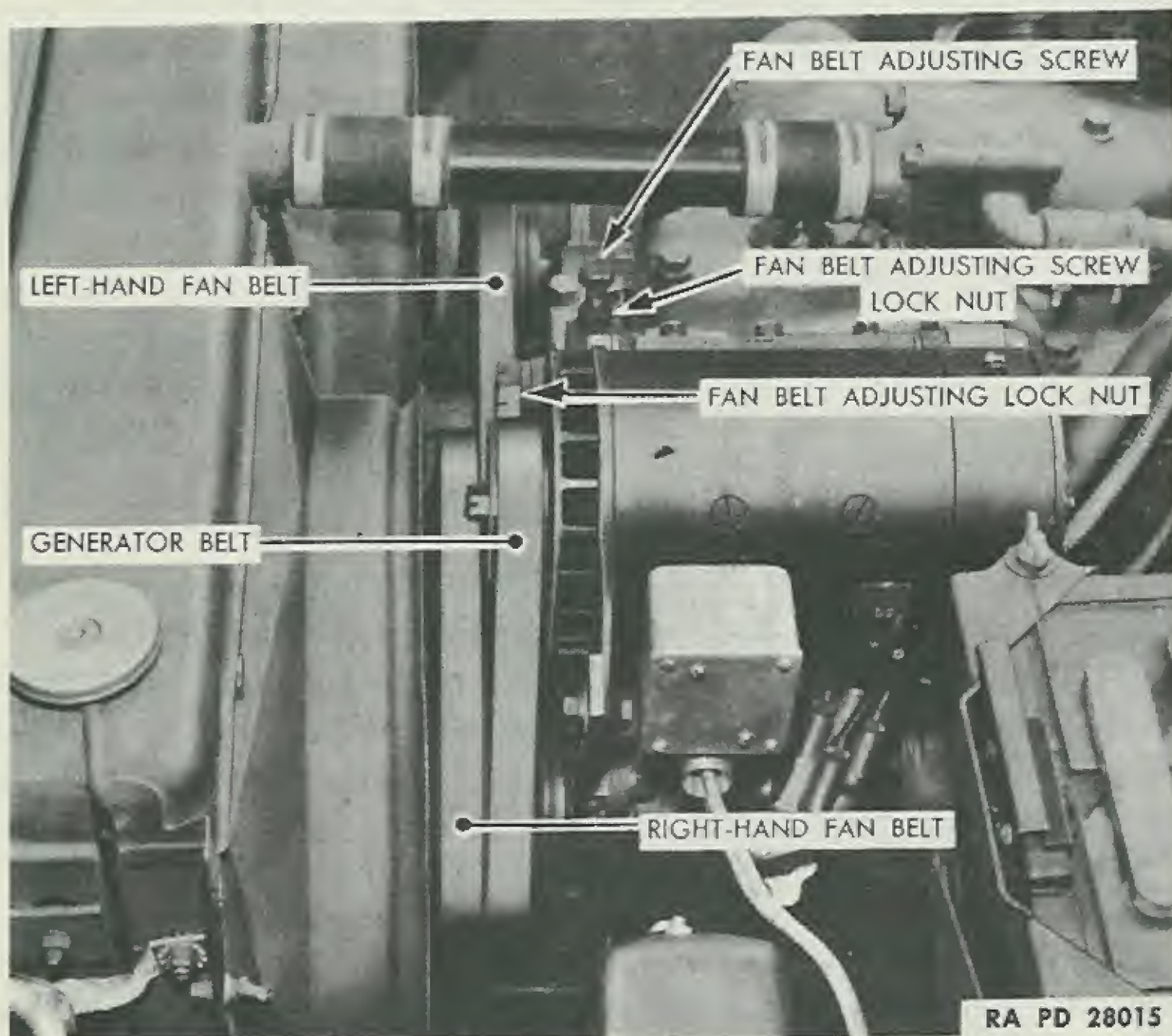


Figure 27 — Fan Belts

c. Replacement.

(1) REMOVAL. Loosen the belt adjustment as outlined in subparagraph b, above, and remove the belts.

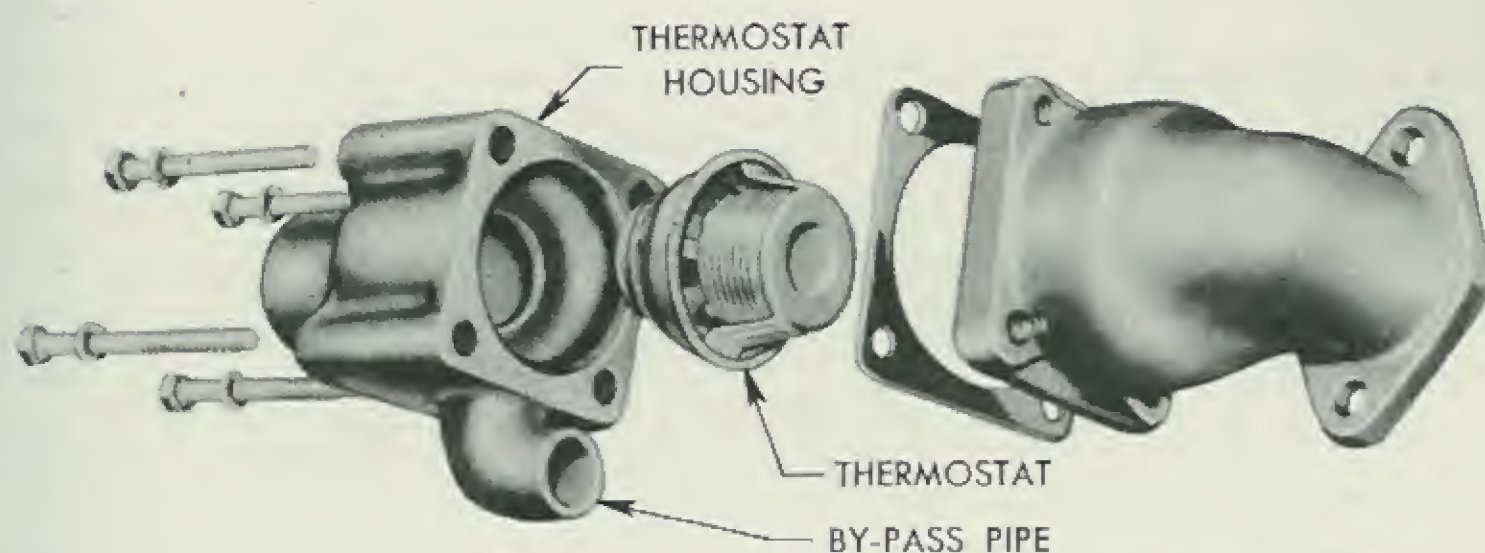
(2) INSTALLATION. To install belts, reverse removal procedure and adjust as outlined in subparagraph b above.

82. THERMOSTAT (fig. 28).

a. Description. The engine is equipped with a bellows-type thermostat that starts to open at 160 degrees and is fully open at 176 degrees

COOLING SYSTEM

(fig. 28). When the thermostat is closed, the water from the water pump is recirculated through the engine by means of a bypass pipe and not through the radiator.



RA PD 28016

Figure 28 — Thermostat

b. Replacement.

(1) **REMOVAL.** To remove the thermostat, drain the cooling system (par. 76 d) to a level below the top of the cylinder head. Loosen the hose clamp on the bypass pipe and remove the pipe. Remove the 4 screws holding the thermostat housing. Remove the housing and lift out the thermostat.

(2) **INSTALLATION.** Reverse sequence of the steps in the removal procedure.

83. HOSE.

a. Rubber hose is used at the various water connections on the engine. All hose connections are held on with clamps and are easily removed.

LIGHT ARMORED CAR M8

Section XVII

ELECTRICAL SYSTEM

	Paragraph
General description	84
Generating system	85
Generator	86
Generator regulator	87
Battery	88
Battery cables	89
Starting system	90
Starting motor	91
Starting solenoid	92
Lamps	93
Instrument panel	94
Water temperature gage	95
Voltmeter	96
Oil pressure gage	97
Fire detector signal system	98
Starter switch button	99
Circuit breakers	100
Siren	101
Siren push button	102
Light switch	103
Blackout driving switch	104
Instrument panel lights	105
Instrument panel light rheostat	106
Ammeter	107
Fuel level gage	108
Battery master switch	109
Conduit and cables	110
Trouble shooting	111
Wiring	112

84. GENERAL DESCRIPTION.

a. The electrical system of the Light Armored Car M8 is the so-called 12-volt system. The engine is equipped with a 750-watt generator. All units of the electrical system with the exception of the blackout head lamps are 12-volt. The blackout head lamp is 6-volt. Figure 29 is a wiring diagram of the vehicle.

ELECTRICAL SYSTEM

RA PD 28017

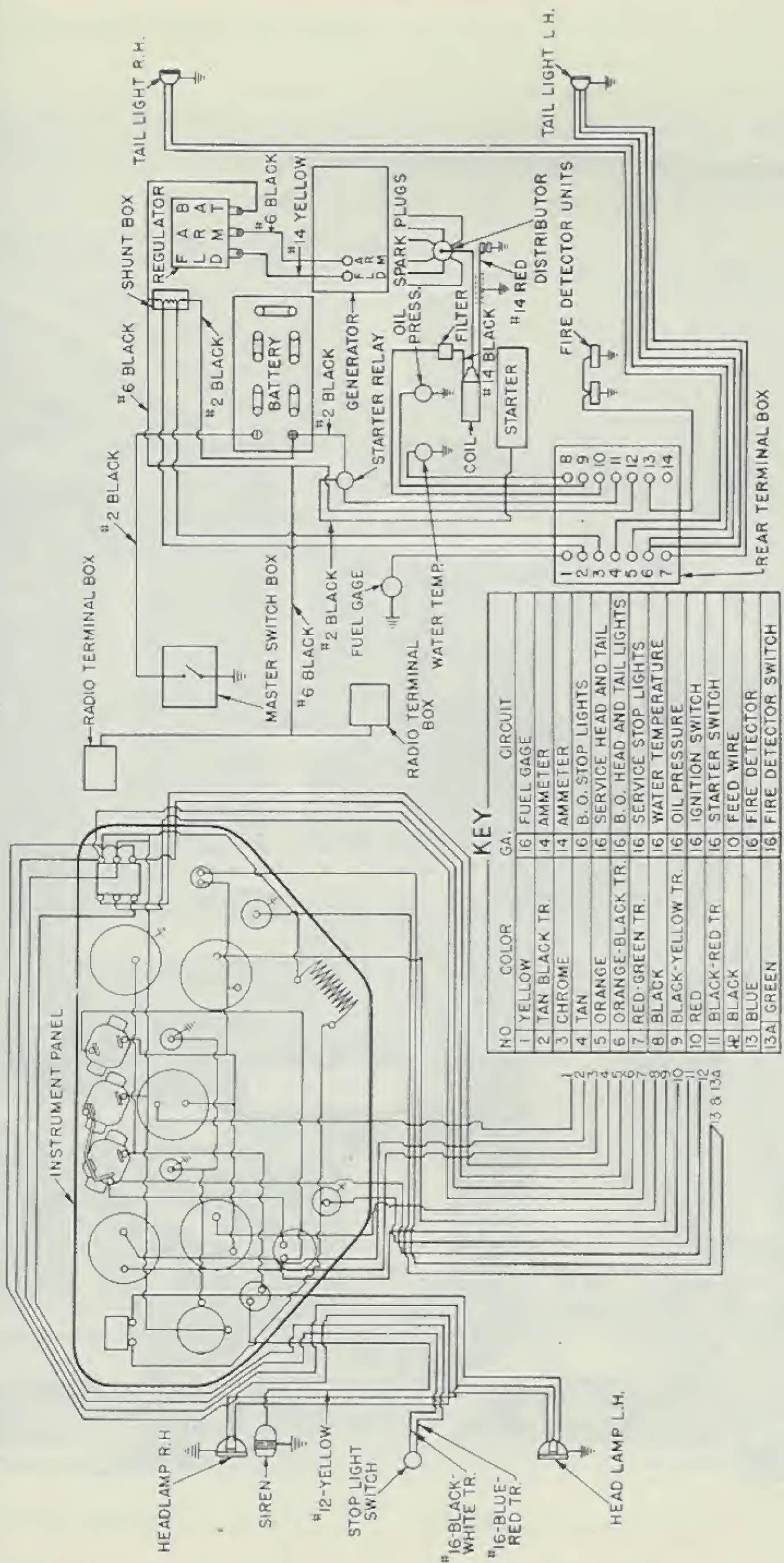


Figure 29 — Wiring Diagram

LIGHT ARMORED CAR M8

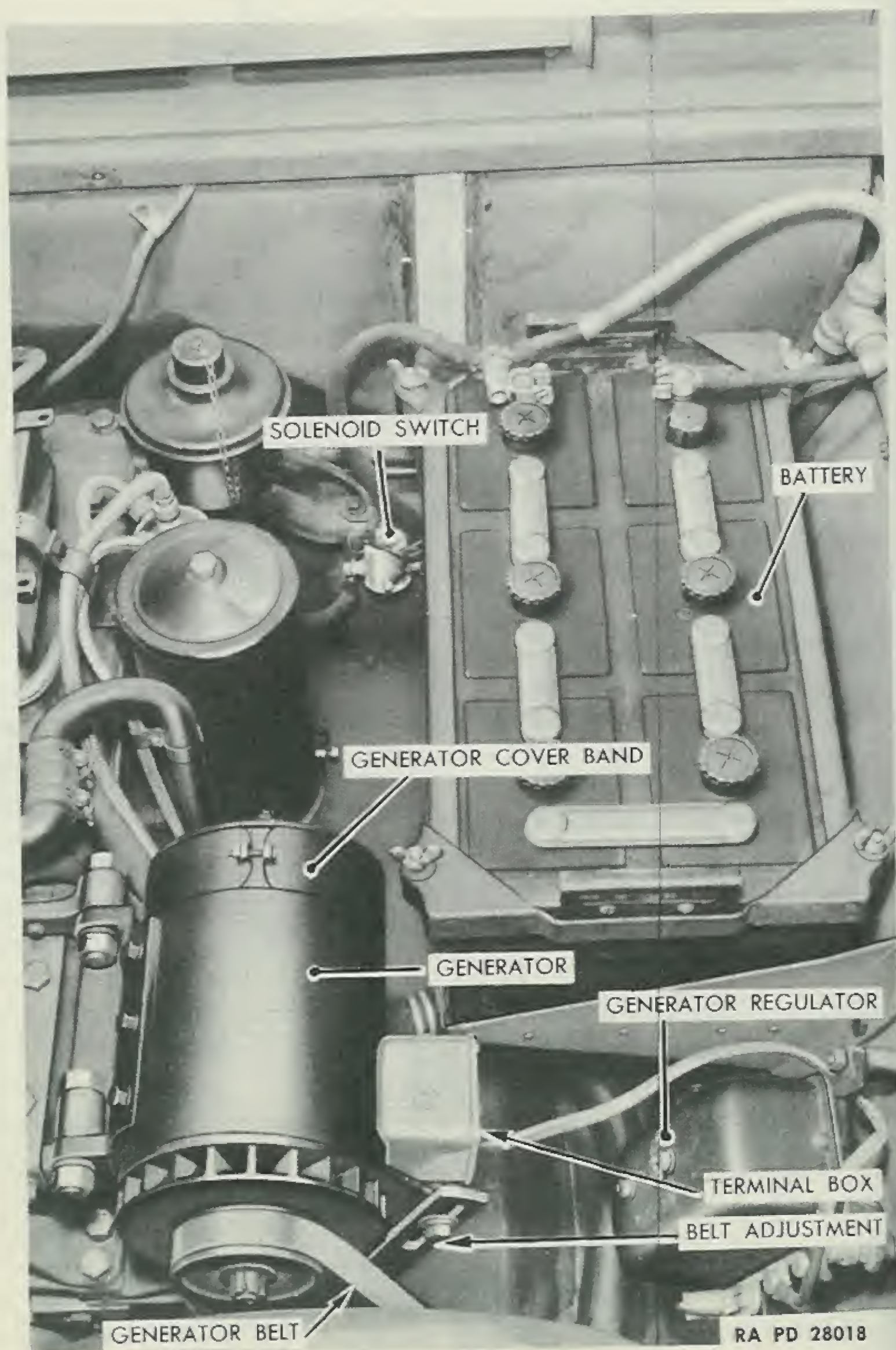


Figure 30 — Generating System

ELECTRICAL SYSTEM

85. GENERATING SYSTEM.

a. **Description.** As shown in figure 30 the generating system consists of generator (par. 86), the generator regulator (par. 87), the battery (par. 88), the various connecting wires and an overload circuit breaker (par. 100 a). In the event of failure the entire system, including the ground circuit, must be considered.

b. **Ground Circuit.** The path of the current from the generator to the battery through ground is of equal importance with the other side of the circuit. The ground circuit includes the battery ground, the contact between the engine and the hull and the contact between generator body and the engine. All of these contacts must be clean and free from paint to assure good electrical contact. Excessive electrical resistance at any of these points will cause the generator voltage to rise in its endeavor to overcome the resistance, with the result that the generator regulator will limit the output of the generator before the battery is fully charged.

c. **Armature Brush to Battery Circuit.** The path of the current from the generator armature brush to the battery passes through a circuit breaker located in the generator terminal box (fig. 30), the generator regulator (fig. 30), including the cutout points. Any extra resistance in the circuit will result in the regulator limiting the generator before the battery is fully charged. If the generator regulator case is not properly grounded to the hull, the cutout will not close and the generator cannot charge the battery.

d. **Trouble Shooting.**

(1) BATTERY FULLY CHARGED BUT USES EXCESSIVE WATER.

Probable Cause	Probable Remedy
Generator regulator faulty (subpar. c, above).	Replace (par. 87 c).

(2) BATTERY FAILS TO CHARGE OR CHARGES INSUFFICIENTLY.

Generator ground circuit resistance (subpar. b, above).	Remove resistance (subpar. b, above).
Generator armature brush to battery circuit resistance (subpar. c, above).	Remove resistance (subpar. c, above).
Generator regulator faulty.	Replace (par. 87 c).
Generator faulty.	Replace (par. 86 d).

LIGHT ARMORED CAR M8

Probable Cause	Probable Remedy
(3) BATTERY CHARGES FULLY BUT RUNS DOWN QUICKLY.	
Battery is worn out or defective.	Replace (par. 88 d).
Short circuit.	Locate and correct short (par. 111 b (2)).
Cutout points fail to open.	Replace generator regulator (par. 87 c).
(4) GENERATOR BURNS OUT.	
Faulty generator regulator.	Replace generator (par. 86 d) and generator regulator (par. 87 c).
Armature and field wires transposed at either the generator or the regulator.	Replace the generator (par. 86 d) and the generator regulator (par. 87 c) and connect wires correctly (fig. 29).
(5) GENERATOR FAILS TO GENERATE OR GENERATES INSUFFICIENTLY.	
Generator burned out.	Replace generator (par. 86 d) and generator regulator (par. 87 c) making sure armature and field wires are not transposed.
Generator commutator dirty (par. 86 b (2)).	Clean commutator with PAPER, flint, No. 00.
Generator commutator worn (par. 86 b (2)).	Replace generator (par. 86 d).
Generator brushes worn.	Replace brushes.
Generator brushes sticking (par. 86 b (2)).	Free brushes.
Excessive resistance in generator ground circuit (subpar. b, above).	Remove resistance (subpar. b, above).
Excessive resistance in generator armature brush to battery circuit (subpar. c, above).	Remove resistance (subpar. c, above).
Resistance in cutout points (subpar. c, above).	Replace generator regulator (par. 87 c).
Voltage regulation incorrect (subpar. c, above).	Replace generator regulator (subpar. c, above).

ELECTRICAL SYSTEM

Probable Cause	Probable Remedy
Current limitation incorrect (subpar. c, above).	Replace generator regulator (subpar. c, above).
Cutout closing voltage too high (subpar. c, above).	Replace generator regulator (subpar. c, above).
Cutout points fail to close due to the generator regulator not being grounded.	Establish a good ground from the regulator housing to the hull, to complete cutout shunt coil circuit.
Cutout points fail to close due to defective shunt coil.	Replace generator regulator (par. 87 c).
Generator belt slipping.	Adjust (par. 86 c).
Generator or fan belts broken or missing.	Install new belts (par. 86 c).

(6) AMMETER READS ABOVE NORMAL (par. 6 a (5)).

Ammeter defective.	Replace ammeter (par. 107 b).
Generator regulator not limiting the current.	Replace generator regulator (par. 87 c).

(7) VOLTMETER READS ABOVE NORMAL (par. 6 a (2)).

Voltmeter defective.	Replace voltmeter (par. 96 b).
Generator regulator not limiting the voltage.	Replace the generator regulator (par. 87 c).

86. GENERATOR (fig. 30).

a. **Description.** A special Ford generator is used. The generator rating is 12 volts, 50 amperes, and its capacity is 750 watts. Current control is obtained by a generator regulator mounted on the side of the hull in the engine compartment (fig. 30). An automatic circuit breaker is located on the inside of the cover of the terminal housing on the generator (fig. 30). The generator is driven by a V-belt as shown in figure 30.

b. Generator Maintenance.

(1) **LUBRICATION.** Generators are properly lubricated at overhaul periods and should not require additional lubricant between overhaul periods.

LIGHT ARMORED CAR M8

(2) **INSPECTION.** The cover band should be removed for the inspection of the commutator and brushes at regular intervals. Check the brushes for sticking and check the commutator for wear. If the commutator is out of round, badly worn or scored, replace the generator. If the commutator is dirty, it may be cleaned with PAPER, flint, No. 00. *Never use emery cloth to clean the commutator.*

c. **Belt Adjustment or Replacement.** The generator belt is properly adjusted with $\frac{1}{2}$ inch of movement can be obtained with the thumb and finger at point midway between the pulleys. To adjust or replace the belt, loosen the adjustment lock bolt and raise or lower the generator as required to remove or install the belt and to obtain the correct adjustment. Retighten the lock bolt when the correct adjustment has been obtained.

d. **Generator Replacement.**

(1) **REMOVAL.** Take out 4 screws from the cover on the generator terminal box (fig. 30) and remove the cover. Disconnect the wires from the field and armature terminals. Remove 4 screws holding the terminal box to the generator and lift terminal box, wires and conduits from the generator. Remove 2 bolts from the mounting bracket (fig. 30) and the adjustment locking bolt and lift the generator from the engine.

(2) **INSTALLATION.** Reverse sequence of the steps of the removal procedure and adjust the belt (subpar. d (1), above).

87. GENERATOR REGULATOR (fig. 30).

a. **Description.** A 3-unit type generator regulator mounted on the side of the hull (fig. 30) is provided and includes a voltage regulator, current limiter and a reverse current relay or cutout.

(1) **THE VOLTAGE REGULATOR.** The voltage regulator unit maintains the output of the generator at a constant predetermined voltage of from 13.5 to 14.5 volts (at 70 F ambient), depending on the state of charge of the battery.

(2) **THE CURRENT LIMITATOR.** The current output on the generator is automatically varied in accordance with the state of charge of the battery and the amount of current being used throughout the vehicle. Thus the proper charge is delivered to the battery at all times without danger of overcharging. The current limiter unit limits the current output of the generator to 55 amperes (at 70 F ambient).

(3) **REVERSE CURRENT RELAY OR CUTOUT.** The reverse current relay or cutout prevents the battery from discharging when the generator is

ELECTRICAL SYSTEM

at rest, or when it is not developing normal voltage (par. 6 a (3)). The cutout points close at $12\frac{1}{2}$ to 13 volts (at 70 F ambient).

b. **Adjustments.** When properly installed and operating, the generator regulator will not require any adjusting. If the regulator fails to regulate the voltage or to control the amperage as it should, and it has been determined that the trouble is not caused by a loose connection or a faulty generator, replace the generator regulator.

c. Replacement of Generator Regulator.

(1) **REMOVAL.** Turn battery master switch off (fig. 9). Disconnect all wires from the regulator. Remove the 4 screws holding the regulator in place and remove the regulator.

(2) **INSTALLATION.** Reverse sequence of the steps of the removal procedure.

88. BATTERY (fig. 30).

a. **Description.** A 12-volt storage battery is located in the engine compartment, mounted on the hull on the right-hand side (fig. 30). A battery master switch (fig. 9) is provided. When this switch is off, the battery is disconnected and all electrical circuits are open.

b. **Maintenance and Inspections.** Battery terminals and terminal posts will be frequently checked, cleaned and coated with PETROLATUM. Check the battery fluid level once a week and after every long run. Maintain the level to $\frac{1}{4}$ inch above the top of the plates by adding distilled water. Take a specific gravity reading (subpar. c, below) every 25 hours and exchange a battery having a specific gravity of 1.225 or less (at 80 F) for a fully charged one.

c. **Specific Gravity Tests.** The state of charge of the batteries can be determined by a specific gravity reading. Use a hydrometer equipped with a thermometer and a temperature compensating table and adjust the reading to compensate for the temperature of the electrolyte. A specific gravity reading of 1.225 or less indicates approximately $\frac{1}{2}$ full charge. Batteries nearly discharged are subject to freezing.

d. Replacement of the Battery.

(1) **REMOVAL.** Turn battery master switch (fig. 9) off. Remove the battery cables (fig. 30) from battery. Remove 4 wing nuts from battery cover frame and lift the battery from its bracket.

(2) **INSTALLATION.** Reverse sequence of the steps of the removal operation.

LIGHT ARMORED CAR M8

89. BATTERY CABLES (fig. 30).

a. **Description.** These are heavy cables made up of many strands of small wire and are heavily insulated. As these cables carry heavy current, they must be kept clean and inspected periodically for abrasions of the insulation. Terminal connections are to be cleaned as outlined in paragraph 88 b.

b. **Replacement.** Disconnect cable connections at the battery, ground connection and starting solenoid (fig. 30) and remove cables. To reinstall, reverse the sequence of the steps of the removal procedure.

90. STARTING SYSTEM.

a. **Description.** The starting system consists of the starting motor (par. 91), starting solenoid (par. 92), the starter button on the panel (par. 99), the battery (par. 88), and the various wires and cables connecting these units.

b. **Trouble Shooting.** Trouble shooting for the starting system is covered under the heading of "Trouble Shooting" in the engine section of this book (par. 47).

91. STARTING MOTOR (fig. 21).

a. **Description.** The starting motor is a 12-volt type mounted on the left side of the flywheel housing (fig. 21) and its power is transmitted to the engine through an automatic drive. A solenoid switch (fig. 30) closes the electric circuit to the starting motor when the starter button on the instrument panel is pressed. Rotation of the starting motor shaft causes the pinion of the automatic drive to advance and mesh with the gear on the flywheel. After the engine starts and the speed of the flywheel exceeds that of the starting motor, the pinion releases the flywheel automatically. The starting motor bearings do not require lubricating.

b. **Replacement of Starting Motor.** The starting motor can be removed from the under side of the vehicle. Disconnect the starter cable. Remove the 3 nuts which hold the starting motor to the flywheel housing (fig. 21) and remove the starting motor. To reinstall, reverse sequence of steps of the removal procedure.

92. STARTING SOLENOID (fig. 30).

a. **Description.** The entire circuit from the battery to the starting motor requires heavy cables due to the large amount of current used. In order to avoid the running of heavy cables up to the instrument panel, a solenoid switch is installed in the starting motor circuit (fig. 30). This

ELECTRICAL SYSTEM

solenoid switch closes magnetically when the starter button on the instrument panel is pressed. The starting solenoid switch is mounted in the engine compartment between the battery and the engine (fig. 30).

b. Replacement of the Starting Solenoid. Turn battery master switch (fig. 9) off. Open the right-hand engine compartment door. Disconnect the cables and wires which are attached to the solenoid. Remove the cap screws which hold the starting solenoid to the mounting bracket and remove the starting solenoid. To reinstall, reverse sequence of the steps of the removal procedure.

93. LAMPS.

a. General Description. The front slope of the vehicle mounts either 2 service head lamp and blackout marker lamp combinations (fig. 32), controlled by the light switches on the instrument panel (fig. 5), or a blackout head lamp controlled by the blackout light switch on the instrument panel. When changing from one type to the other, pull out head lamp lock and turn $\frac{1}{4}$ turn. Head lamp assembly can then be lifted out. When neither the service head lamps nor the blackout head lamp are used, be sure the plug provided is inserted in the socket to protect the terminals.

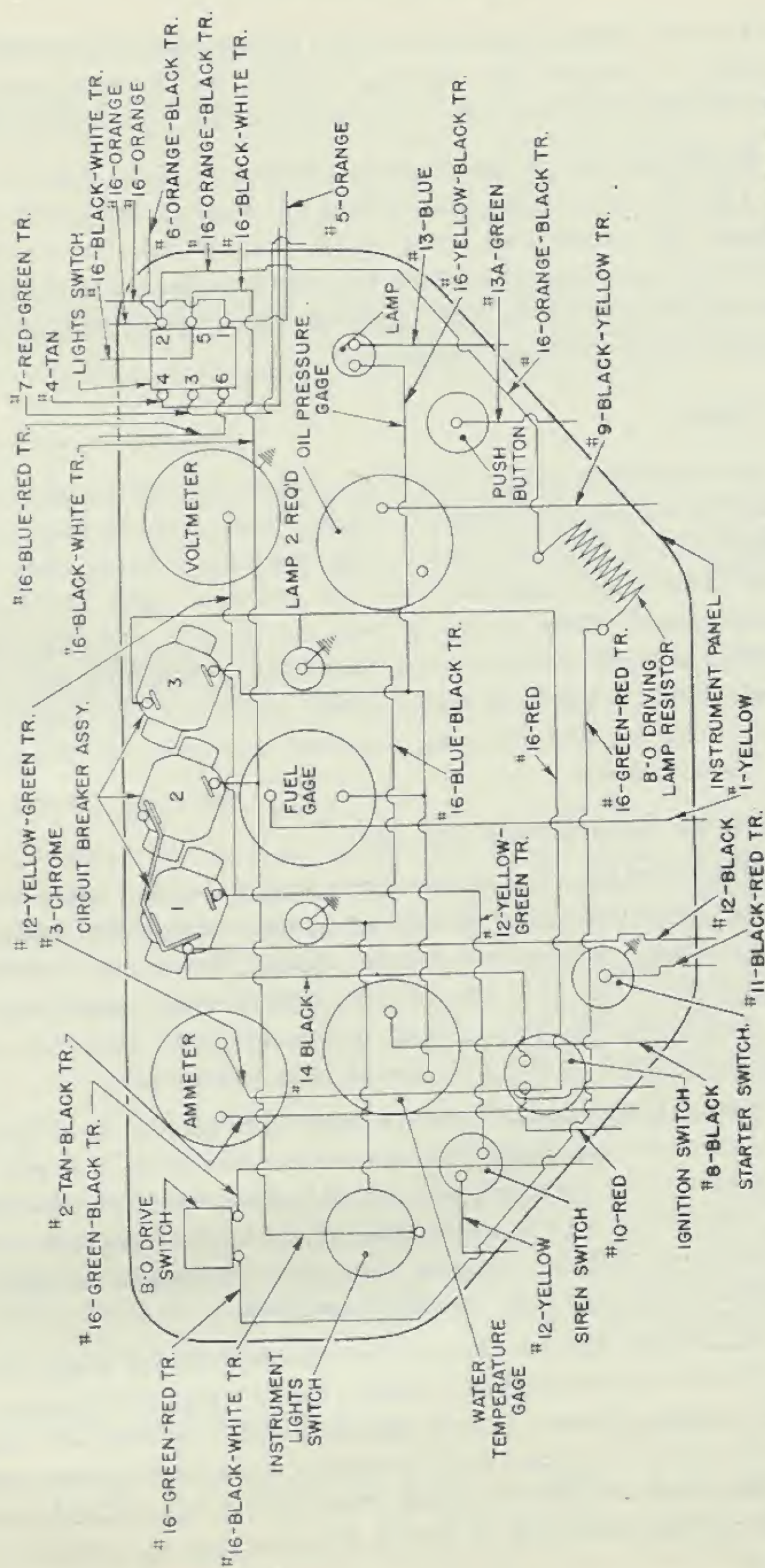
b. Service Head Lamps (fig. 32).

(1) **DESCRIPTION.** The service head lamps are used when there is a possibility that illumination ahead can be used with safety and permits immediate change to blackout marker lights. The service headlight reflectors, however, can pick up and reflect back other lights, and under certain conditions, the service head lamps should be removed and the blackout head lamp or the plug installed in the sockets.

(2) **HEAD LAMP BULB REPLACEMENT.** The service head lamp uses a sealed-beam, 12-volt, single filament bulb and may be removed as follows: Remove screw attaching lens rim to body of head lamp and remove the rim. Disconnect wire from terminal at the back of the bulb. Remove the sealed-beam bulb by releasing tension on springs in retaining ring. Reverse the above procedure to install new bulb.

(3) **BLACKOUT MARKER BULB.** The blackout marker lamps mounted on top of both the service head lamps (fig. 32) and the blackout head lamps use a single-contact, 12-volt, bayonet base, 3-candlepower bulb. To replace the blackout marker bulb, remove screw attaching lens frame to body of lamp and remove the frame. Press bulb in, turn slightly counterclockwise and pull bulb out of socket. Replace bulb by reversing above procedure.

LIGHT ARMORED CAR M8



RA PD 27692

Figure 31 — Instrument Panel Wiring Diagram

ELECTRICAL SYSTEM

c. Blackout Head Lamp.

(1) **DESCRIPTION.** The blackout head lamp throws a thin flat beam of light that cannot be seen from above, yet provides enough illumination to permit missing most obstacles. The bulb is 6-volt, 10-candlepower, and a resistor is included in series in the circuit that permits it to be used in a 12-volt system. To replace the blackout head lamp bulb, proceed as follows:

(2) **REPLACEMENT OF BLACKOUT BULB.** Remove the screw attaching the rim to the blackout head lamp body and remove the rim. Disconnect the wire from the terminal on back of bulb. With a screwdriver, unhook the 6 wire retainers and remove the bulb. Reverse the steps of the above procedure to install a new bulb assembly.

d. Tail Lamps.

(1) **DESCRIPTION.** A tail lamp is mounted in the rear of each side of the vehicle. The lamps in the 2 tail lamps are operated by the light switch on the instrument panel (par. 6 b). Each tail lamp consists of 2 sealed cartridge units, having pinless type bulb bases. The 2 sealed units for each lamp are held in place by a frame, attached to the metal housing or body of the lamp with 2 screws. The left tail lamp assembly has 3 filaments, the service, and service stoplight filaments in the upper cartridge, and the blackout taillight filament in the lower one. The right tail lamp has 2 filaments, the blackout stoplight in the upper cartridge, and the blackout taillight in the lower one. Use the following procedure in replacing the tail lamp or the sealed beam lamp:

(2) **REPLACEMENT OF SEALED LAMP BULB UNIT.** Remove screws attaching lens frame to body of tail lamp. Remove the frame and pull the defective sealed lamp unit straight out to remove it. Reverse sequence of the steps of the removal procedure to install new sealed lamp unit.

(3) **TAIL LAMP REPLACEMENT.** Remove the tail lamp support bracket assembly from the hull by removing 3 retainer bolts. Turn the support bracket over; then reach in and disconnect wire plugs from lamp sockets. Remove 2 nuts fastening the tail lamp assembly to the support bracket. Reverse the steps of the above procedure to reinstall the tail lamp.

94. INSTRUMENT PANEL (fig. 5).

a. **Description.** The instrument panel is located directly in front of the driver. The use of the various instruments and devices are completely covered in paragraph 6 a (1) through (17). When replacing any

LIGHT ARMORED CAR M8

of the instruments, note the color of the various wires as shown in figure 31 so as to insure the correct installation.

b. Replacement of Instrument Panel.

(1) **REMOVAL.** Turn battery master switch off (fig. 9). Disconnect the instrument panel conduit and wires at the junction box mounted on the left wall of the driver's compartment. Disconnect instrument panel conduit and wires at the battery master switch. Remove the instrument panel face and disconnect ignition switch wires. Disconnect the speedometer drive from the speedometer head. Remove the 3 cap screws from the back of instrument panel which secure the panel to the mounting bracket and remove the instrument panel.

c. Installation. Reverse sequence of steps of the removal procedure.

95. WATER TEMPERATURE GAGE (K, fig. 5).

a. Description. The water temperature gage consists of an instrument panel unit and a thermostatically controlled electrical engine unit located in the cylinder head of the engine. The use of the water temperature gage is outlined in paragraph 6 a (9).

b. Replacement of Water Temperature Gage Panel Unit. Remove the instrument panel as outlined in paragraph 94 b (1). Disconnect the 2 wires attached to the gage. Remove the 2 nuts which hold the gage to the panel and remove the gage. To reinstall, reverse sequence of steps of the removal procedure. See figure 31 for wire and color size.

c. Replacement of Water Temperature Gage Engine Unit. Open the engine compartment doors. Drain approximately 2 gallons of water from the cooling system. Remove the 2 screws which hold the conduit shield to the unit and remove the shield. Disconnect the wire running to the unit. Remove the unit from the engine cylinder head. To reinstall, reverse sequence of steps of the removal procedure.

96. VOLTMETER.

a. Description. A voltmeter, having a range from 16 to 32 volts, is provided on the instrument panel. The voltmeter shows the voltage in the charging circuit. The use of the voltmeter is explained in paragraph 6 a (2).

b. Replacement of Voltmeter. Remove the instrument panel as outlined in paragraph 94 b (1). Disconnect the wires attached to the volt-

ELECTRICAL SYSTEM

meter. Remove the 2 nuts which hold the voltmeter to the panel and remove the instrument from the front side of the panel. To reinstall, reverse sequence of steps of the removal procedure. See figure 31 for wire color and size.

97. OIL PRESSURE GAGE.

a. **Description.** The oil pressure gage is electrically operated and consists of a gage in the instrument panel, and an engine pressure unit. The engine unit is located on the right-hand side of the engine crankcase. The operation of the gage is outlined in paragraph 6 b (14).

b. **Replacement of Oil Pressure Gage Panel Unit.** Remove the instrument panel as outlined in paragraph 94 b (1). Disconnect the wires running to the unit. Remove the 2 nuts which hold the unit to the instrument panel and remove the unit. To reinstall, reverse sequence of steps of the removal procedure. See figure 31 for wire colors and sizes.

c. **Replacement of Oil Pressure Gage Engine Unit.** Open the engine compartment doors. Remove the 2 screws which hold the conduit shield to the unit and remove the shield. Disconnect the wire running to the unit. Unscrew the unit from the crankcase and remove. To reinstall, reverse sequence of steps of the removal procedure.

98. FIRE DETECTOR SIGNAL SYSTEM.

a. **Description.** The fire detector signal system consists of a red signal light in the instrument panel; a fire detector test button on the instrument panel; and several thermal units located in the engine compartment. Description and its use is described in paragraph 6 b (15) and (16).

b. **Replacement of Fire Detector Signal Bulb.** The light bulb can be replaced after removing the lens from the front of the panel with a small screwdriver.

c. **Replacement of Fire Detector Test Button.** Remove instrument panel as outlined in paragraph 94 b (1). Remove wires from switch. Remove the fastening nuts and remove the switch from the panel. Reinstall the button by reversing the removal procedure. See figure 31 for wire colors.

d. **Replacement of Thermal Unit.** Disconnect wire from unit. Remove mounting screws and remove the unit. Reinstall by reversing the steps of the removal procedure.

LIGHT ARMORED CAR M8

99. STARTER SWITCH BUTTON.

a. **Description.** The starter button is located on the instrument panel (O, fig. 5). When pushed in, the button completes the circuit through the starter switch solenoid, causing the starting motor to crank the engine.

b. **Replacement of Starter Button.** Remove the instrument panel as outlined in paragraph 94 b (1). Disconnect the wire running to the switch. Remove the nut which holds the switch to the instrument panel. Remove button from front side of panel. To reinstall the button, reverse sequence of steps of the removal procedure. See figure 31 for wire color and size.

100. CIRCUIT BREAKERS (D, E, and F, fig. 5).

a. **Description.** Three circuit breakers are used in the electrical circuits in place of the conventional fuses. The circuit breakers are located on the instrument panel (D, E, and F, fig. 5). A generator circuit breaker is located under the cover of the terminal box on the generator (fig. 30). This circuit breaker protects the generator from burning out due to the cutout points failing to open. If this overload should correct itself, the generator circuit breaker will close automatically.

b. **Replacement of Instrument Panel Circuit Breakers.** Remove the instrument panel as outlined in paragraph 94 b (1). Disconnect the wires from the circuit breaker terminals. Remove the screws from the copper bar which hold the circuit breakers together. Remove 2 screws which hold the circuit breakers to the instrument panel and remove circuit breaker. To reinstall, reverse sequence of steps of the removal procedure. See figure 31 for wire color and size.

c. **Replacement of Generator Circuit Breaker.** Remove the 4 screws from the generator terminal box cover and lift off the cover. Disconnect the 2 wires leading to the circuit breaker. Remove the 2 bolts which hold the circuit breaker to the terminal box cover and remove the circuit breaker. To reinstall, reverse sequence of steps of the removal procedure.

101. SIREN (fig. 32).

a. **Description.** The siren is electrically operated and is controlled by a push button switch (L, fig. 5) on the instrument panel. The siren is mounted on the right front slope of the vehicle.

b. **Replacement of Siren.** Disconnect conduit coupling from bulk-head connector in front slope of armor plate and pull out plug. Remove 2 cap screws holding siren to mounting bracket. Remove the siren. To reinstall the siren, reverse sequence of steps of the removal procedure.

ELECTRICAL SYSTEM

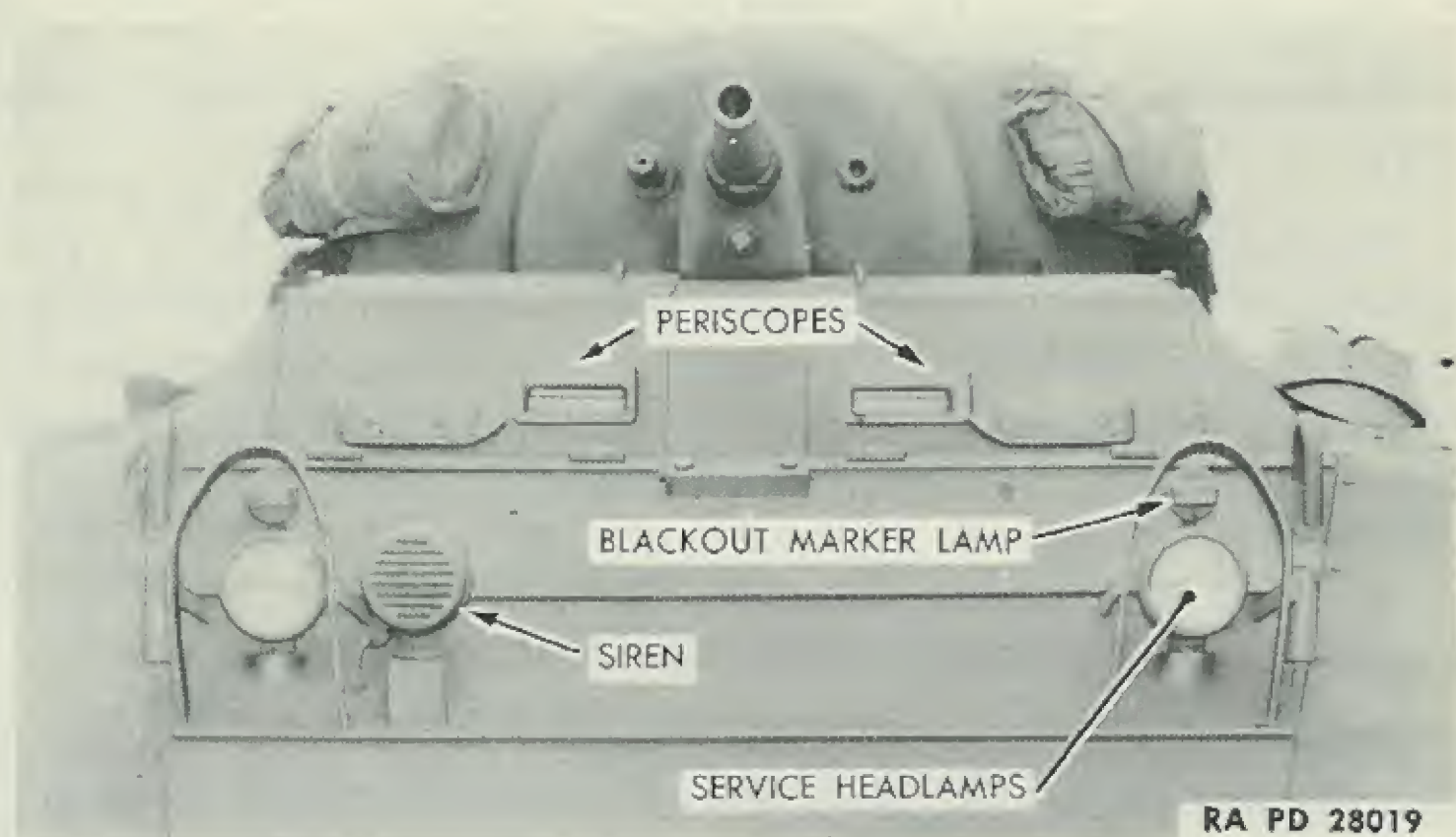


Figure 32 — Head Lamps and Siren

102. SIREN PUSH BUTTON (L, fig. 5).

a. **Description.** The siren switch is a push button type. The switch is mounted to the instrument panel.

b. **Replacement of Siren Push Button.** Remove the instrument panel as outlined in paragraph 94 b (1). Disconnect the wire that runs to the switch. Remove the nut which holds the switch to the instrument panel and remove the button from the front side of the panel. To install the switch, reverse sequence of steps of the removal procedure.

103. LIGHT SWITCH (A, fig. 5).

a. **Description.** The use of the light switch is described in paragraph 6 b (1).

b. **Replacement.** Remove the instrument panel (par. 94 b (1)). Pull the button all the way out by pressing the spring button on the side of the switch. Remove the nut at the top of the switch and pull the housing back. Remove the button from the switch by loosening the small lock screw and unscrew the button. Disconnect and tag the wires from the switch. Remove the nut which holds the switch to the instrument panel and remove the switch. To reinstall the switch, reverse sequence of steps of the removal procedure, referring to figure 31 for wire colors.

LIGHT ARMORED CAR M8

104. BLACKOUT DRIVING SWITCH (H, fig. 5).

a. **Description.** The operation of the switch is described in paragraph 6 b (6).

b. **Replacement.** Remove the instrument panel (par. 94 b (1)). Pull button all the way out, loosen the small lock screw and unscrew the button. Disconnect and tag the 2 wires from the switch. Remove the nut which holds the switch to the panel and remove the switch. To reinstall, reverse the sequence of steps of removal procedure, referring to figure 31 for wire colors.

105. INSTRUMENT PANEL LIGHTS (C, fig. 5).

a. The instrument panel is illuminated by 2 light bulbs located in back of the instrument panel, each directly behind a pronged removable plug on the face of the panel. To replace the bulb, remove the plug from the front of the instrument panel, press in on the bulb at the same time turning it counterclockwise until released, when it may be pulled out.

106. INSTRUMENT PANEL LIGHT RHEOSTAT (J, fig. 5).

a. **Description.** The panel light rheostat switch is provided with 5 positions which control the brilliance of the panel lights. The panel light rheostat switch is located in the lower left-hand corner of the instrument panel (J, fig. 5).

b. **Replacement of Rheostat Switch.** Remove the instrument panel as outlined in paragraph 94 b (1). Loosen the lock screw in the control knob and remove the knob. Remove the holding nut from the switch and remove the switch from the panel. Disconnect the wires attached to the switch. To reinstall, reverse sequence of steps of the removal procedure. See figure 31 for wire color and size.

107. AMMETER (G, fig. 5).

a. **Description.** The ammeter has a range of 100-ampere discharge to 100-ampere charge. The use of the ammeter is covered in paragraph 6 b (5).

b. **Replacement of Ammeter.** Remove the instrument panel as outlined in paragraph 94 b (1). Remove the 2 nuts which hold the ammeter to the panel and remove the instrument from the front side of the panel. Disconnect the wires and remove ammeter. To reinstall the ammeter, reverse sequence of steps of the removal procedure. See figure 31 for wire color and size.

ELECTRICAL SYSTEM

108. FUEL LEVEL GAGE (M, fig. 5).

a. **Description.** The fuel level gage consists of two units, the gage on the instrument panel and the fuel tank unit. The operation of the fuel level gage is explained in paragraph 6 b (10).

b. **Replacement of Panel Unit.** Remove the instrument panel as outlined in paragraph 94 b (1). Remove the 2 nuts which hold the gage to the panel and remove the gage from the front of the panel. Disconnect the wires running to the gage. To reinstall the panel unit, reverse sequence of steps of the removal procedure. See figure 31 for wire color and size.

109. BATTERY MASTER SWITCH (fig. 9).

a. **Description.** The battery master switch is located in the fighting compartment in the upper rear right-hand corner (fig. 9). The use of the master switch is described in paragraph 6 c (11).

b. **Replacement of Battery Master Switch.** Disconnect the wires at the switch terminals. Remove the mounting screws and remove the master switch. To reinstall, reverse sequence of steps of the removal procedure.

110. CONDUIT AND CABLES.

a. **Purpose.** Two objectives are achieved by the use of flexible metal conduit and junction boxes over the high and low tension automotive wire used in these vehicles. The conduit protects the insulation of the wire against wear and abrasion and it is oil and water sprayproof. Radio interference is cut to a minimum because the conduit and junction box provides a continuous grounded circuit over the entire wiring system.

b. **Maintenance.** During the 5,000-mile preventive maintenance and inspection, inspect all conduits for wear and abrasion, loosening of coupling nuts, and loose or missing conduit support clamps or brackets. At any point where abrasion of the conduit appears, the spot should be strapped down or covered with friction tape to prevent further wear. Conduit supports and clamps should grasp the conduit firmly to prevent abrasion. Replace missing supports and clamps. Tighten loose supports, clamps, and conduit couplings. Clean all dirty conduits. In cleaning couplings use SOLVENT, dry-cleaning, if CARBON TETRACHLORIDE is not available. After cleaning and drying, the threads of each coupling and connector should be cleaned with a wire brush to remove oxidation which sometimes forms on the threads of aluminum couplings. This oxidation, par-

LIGHT ARMORED CAR M8

ticularly on the ignition harness fittings, breaks the grounded circuit and causes radio interference.

c. Replacement.

(1) **GENERAL INSTRUCTIONS.** Replace wires that show broken or hardened insulation at points where they come out of the conduit, or that have become oil-soaked through failure of a conduit. If the conduit or terminal box is badly crushed, replace the box or that section of the conduit that is crushed and the wires contained therein. Before disconnecting any wire from the circuit, fasten a tag to the terminal post being worked on, stating the number of wires, size and color of each wire, and where the other end of each wire is connected. If this precaution is not followed, it will be necessary to consult the wiring diagram and trace out the circuit.

(2) **REMOVAL.** Disconnect the conduit couplings and the enclosed wires. Remove bracket or clamp supporting conduit. Attach a piece of strong twine to the end of each wire before removing the wire from the conduit. The twine can be used in pulling cleaning cloths through a dirty but otherwise serviceable piece of conduit.

(3) **INSTALLATION.** Use only standard automotive ignition or primary wire of the same size and color as the wire removed. The wire may be pulled through the conduit by means of the heavy twine left in the conduit when the defective wire was withdrawn (par. 112). Clean terminal posts and wire terminals before connecting the wire into the circuit. If the tags or marks on terminals are missing, consult the wiring diagram (fig. 29).

111. TROUBLE SHOOTING.

a. Ignition Trouble Shooting. Ignition trouble shooting is covered in the "Engine" section under paragraph 47.

b. Low Tension Circuit Trouble Shooting.

(1) **GENERAL.** In the following discussion the generator regulator, battery and the generator are assumed to be in operating condition. The functions of these units are discussed in paragraphs 86, 87, and 88, respectively. Trouble shooting for the generating system is covered in paragraph 85 d. In the balance of the electrical system the two general types of electrical trouble are open circuits (par. 111 b (3)), and short circuits (par. 111 b (2)).

(2) **SHORT CIRCUITS.** Short circuits occur when for some reason the current is bypassed back to the battery through ground instead of through the unit for which it was intended. Quite often sufficient current passes

ELECTRICAL SYSTEM

through the defect in the circuit to start the insulation burning which permits easy location of the trouble. In other cases where there is considerable electrical resistance in the circuit, the amperage will be so low that a fire will not be started. These shorts can be located by checking the various portions of the circuit by placing a voltmeter parallel to the wire to be tested (circuit turned on). A short circuit will be indicated by voltage reading being considerably lower than the battery voltage. Check various portions of the circuit until defective wire is located.

(3) **OPEN CIRCUITS.** Open or partially open circuits cut off or reduce the current in the circuit. Open or high resistance circuits can be located by placing a voltmeter parallel to the portion of the circuit to be tested with the current turned on. If the circuit is open, a reading of full battery voltage will be obtained. If the circuit is of high resistance, the reading will be almost full battery voltage. The amount of the voltage drop will vary for the various circuits, depending on the normal resistance of the particular circuit being tested. The reading likewise will be controlled by the sensitivity of the voltmeter being used. Conditions to look for in locating electrical trouble are, in the order of their probability, as follows:

- (a) Loose, dirty or corroded connections.
- (b) Inoperative or defective equipment.
- (c) Defective or corroded switches and plug connectors.
- (d) Worn conduits and broken or bare wires.

112. WIRING.

a. The wiring diagrams, figures 29 and 31, give the size and color of the wire used in the various circuits. When it is necessary to install new wires, it will be necessary, generally, to solder the terminals on the wire after the wire has been installed (par. 110 c) in the conduit. The color scheme should be adhered to and do not, for any reason, change the wire size in any portion of a circuit. Tag all wires during change. In stripping insulation from a wire to make a connection, do not damage the wire. Allow 3 or 4 inches of slack in installing the wires to switches where the terminals must be clipped off in order to replace the defective switch. Since oil and gasoline are injurious to insulation, keep all exposed wires clean, and check frequently for loose or corroded connections.

LIGHT ARMORED CAR M8

Section XVIII

NONELECTRICAL INSTRUMENTS

	Paragraph
Speedometer	113
Turret compass	114

113. SPEEDOMETER (P, fig. 5).

a. **Description.** The speedometer is located in the center of the instrument panel at the bottom and is equipped with a trip mileage reset (Q, fig. 5). The speedometer consists of three units, the head, drive cable and the drive unit. The speedometer drive unit is located on the left rear side of the transfer case (fig. 38).

b. **Speedometer Head Replacement** (fig. 5). Remove the instrument panel as outlined in paragraph 94 b (1). Disconnect the speedometer cable by unscrewing the knurled nut at the back of the speedometer head. Disconnect the trip set from the clip at the bottom of the instrument panel. Remove the 2 wing nuts from the speedometer clamp and remove the speedometer head from the front of the panel. Reinstall the head by reversing sequence of the steps of the removal procedure.

c. **Speedometer Drive Cable Replacement** (fig. 38). Unscrew knurled nut from the back of the speedometer head and disconnect the drive cable. Unscrew the knurled nut and disconnect the drive cable from the drive unit on the transfer case (fig. 38). Pull the cable out of the housing from the instrument panel end. Reinstall the cable by reversing sequence of the steps of the removal procedure.

d. **Speedometer Drive Unit Replacement** (fig. 38). Unscrew the knurled nut securing the drive cable to the drive unit and disconnect drive cable. Remove the 4 cap screws which secure the drive unit to the transfer case and remove the drive unit. To reinstall, reverse the sequence of steps of the removal procedure.

114. TURRET COMPASS (fig. 33).

a. **Description.** The turret compass is mounted directly above the 37-mm gun. The compass is rubber-mounted to decrease vibration.

b. Compensation.

(1) **GENERAL INSTRUCTIONS.** To overcome the magnetic effect of the steel and electrical equipment in the vehicle, it is necessary to com-

NONELECTRICAL INSTRUMENTS

compensate the compass. Use a coin to make adjustments. Do not use a screwdriver as it may be magnetic. Before beginning compensation, be sure the compensator screw slots marked "N-S" and "N-W" (fig. 33) are in approximate vertical position.

(2) ADJUSTING COMPASS.

(a) *Head the Vehicle North and Adjust.* Head the vehicle north, turn the lower compensator screw slot marked "N-S" (fig. 33) only as

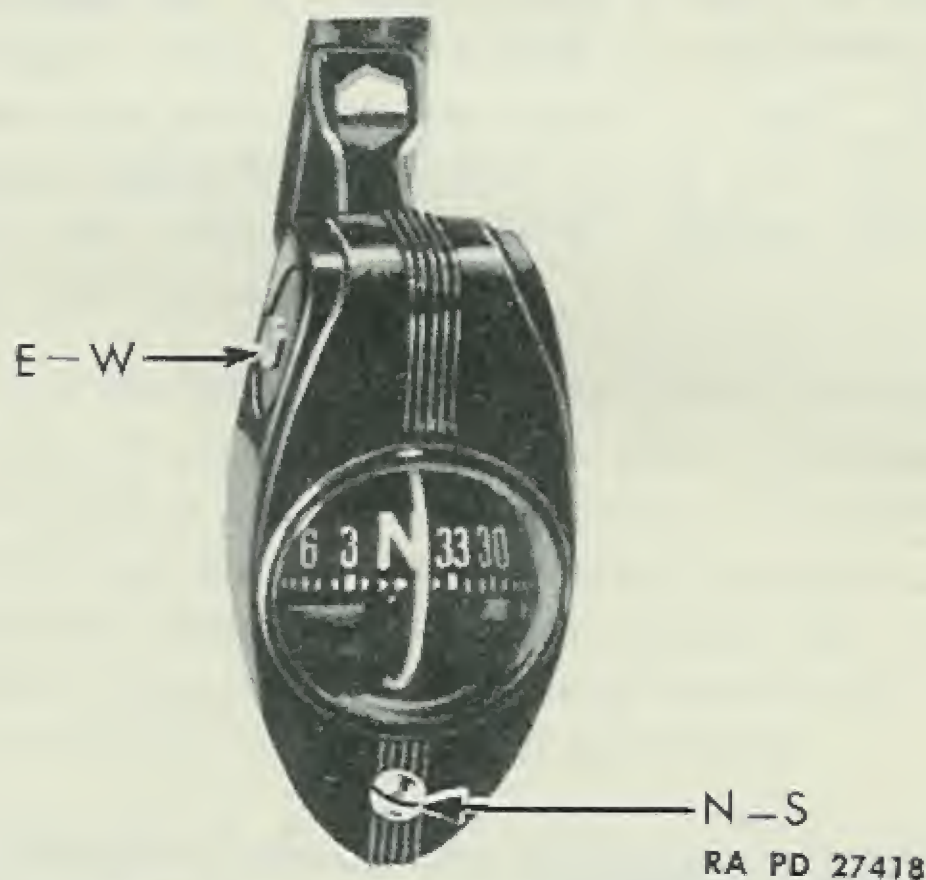


Figure 33 - Turret Compass

far as necessary to make the dial read "NORTH" or "SOUTH," no farther.

(b) *Head the Vehicle East and Adjust.* Head the vehicle east, turn the upper compensator screw slot marked "E-W" (fig. 33) only as far as necessary to make the dial read "EAST," no farther.

(c) *Head the Vehicle South and Adjust.* Head the vehicle south, turn the lower compensator screw slot marked "N-S" (fig. 33) slightly if necessary, to make the dial read "SOUTH."

(d) *Head the Vehicle West and Adjust.* Head the vehicle west, turn the upper compensator screw slot marked "E-W" (fig. 33) slightly if necessary, to make the dial read "WEST."

(3) CORRECTING ADJUSTMENT. If the dial reads "SOUTH" instead of "NORTH," completion of step (2) will correct this condition. If the north or south is slightly off, correct by turning the lower screw marked "N-S" (fig. 33). If the east or west is slightly off, correct by turning the upper screw marked "E-W." Do not turn upper screw for north or south adjustment. Do not turn lower screw for east or west adjustment.

LIGHT ARMORED CAR M8

(4) DRIFT. Do not make adjustments in a steel building or near heavy electrical equipment. In some instances, the magnetic characteristics of heavy vehicles are such that, after the compass is compensated, the dial is inclined to drift by one of the cardinal points. The condition can be corrected by turning one of the compensator screw slots one-half turn (approximately 180 degrees) and then recompensating the compass.

(5) COMPASS DRIFT ADJUSTMENT. If the compass is inclined to drift by the "NORTH" or "SOUTH," the upper compensator screw slot marked "E-W" (fig. 33) should be turned over and the compass recompensated. If the drift is on "EAST" or "WEST," turn the lower compensator screw marked "N-S" one-half turn and recompensate the compass.

Section XIX

CLUTCH

	Paragraph
Description and data.....	115
Controls	116
Maintenance	117
Adjustment	118
Clutch disk and pressure plate.....	119
Clutch master cylinder.....	120
Clutch slave cylinder.....	121
Hydraulic lines	122
Bleeding hydraulic lines.....	123

115. DESCRIPTION AND DATA.

a. The engine is equipped with a Long Manufacturing Company dry-type, single-plate clutch, model 12CB-C, which is hydraulically controlled. The clutch friction facings are 12 inches in diameter. The total friction area is 149.3 square inches. The clutch pressure plate is adjusted, and the release levers locked at the factory. No adjustment is required other than to maintain the clearance between the release fork and the release bearing, as outlined in paragraph 118.

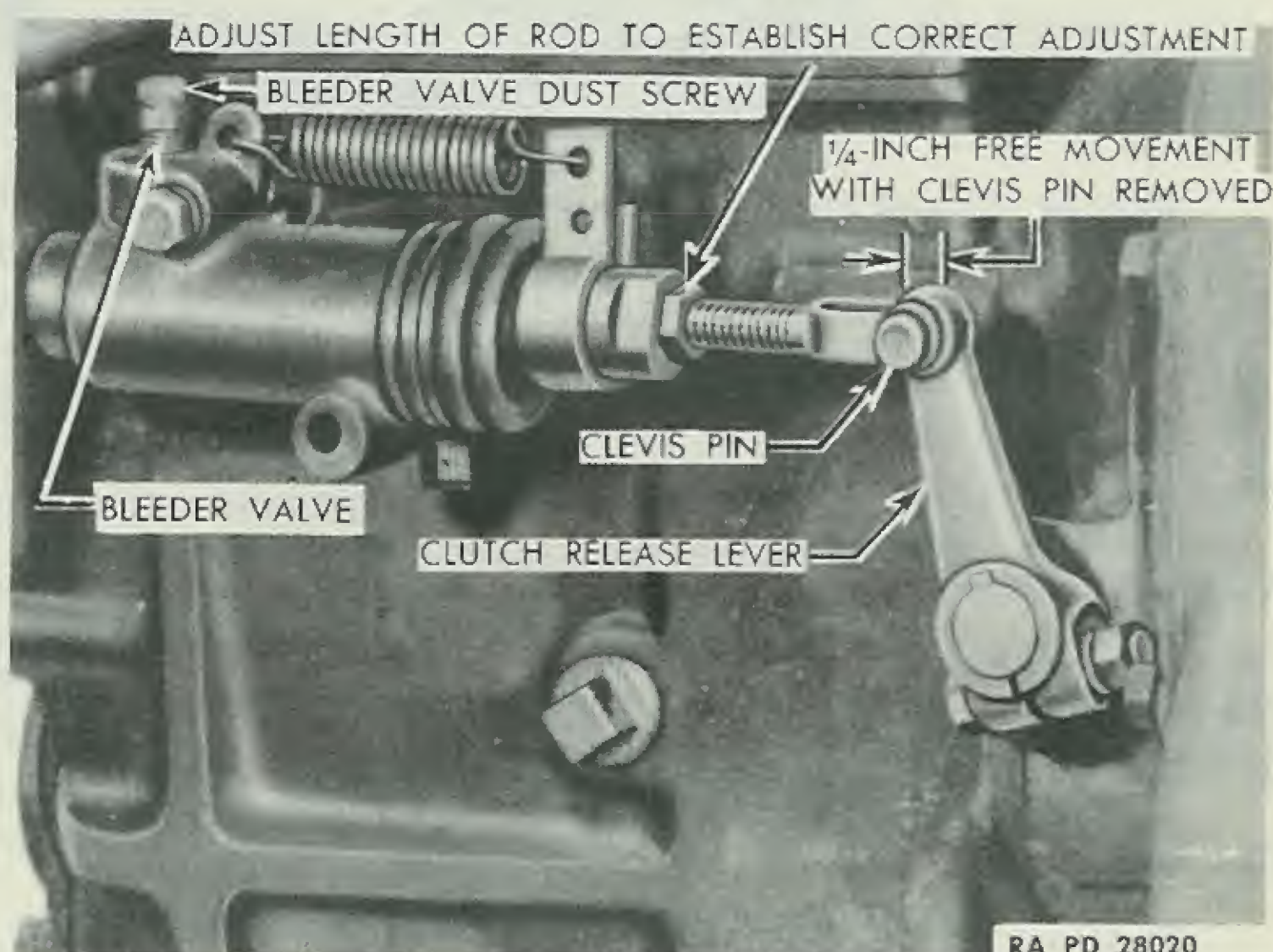


Figure 34 — Clutch Adjustment

LIGHT ARMORED CAR M8

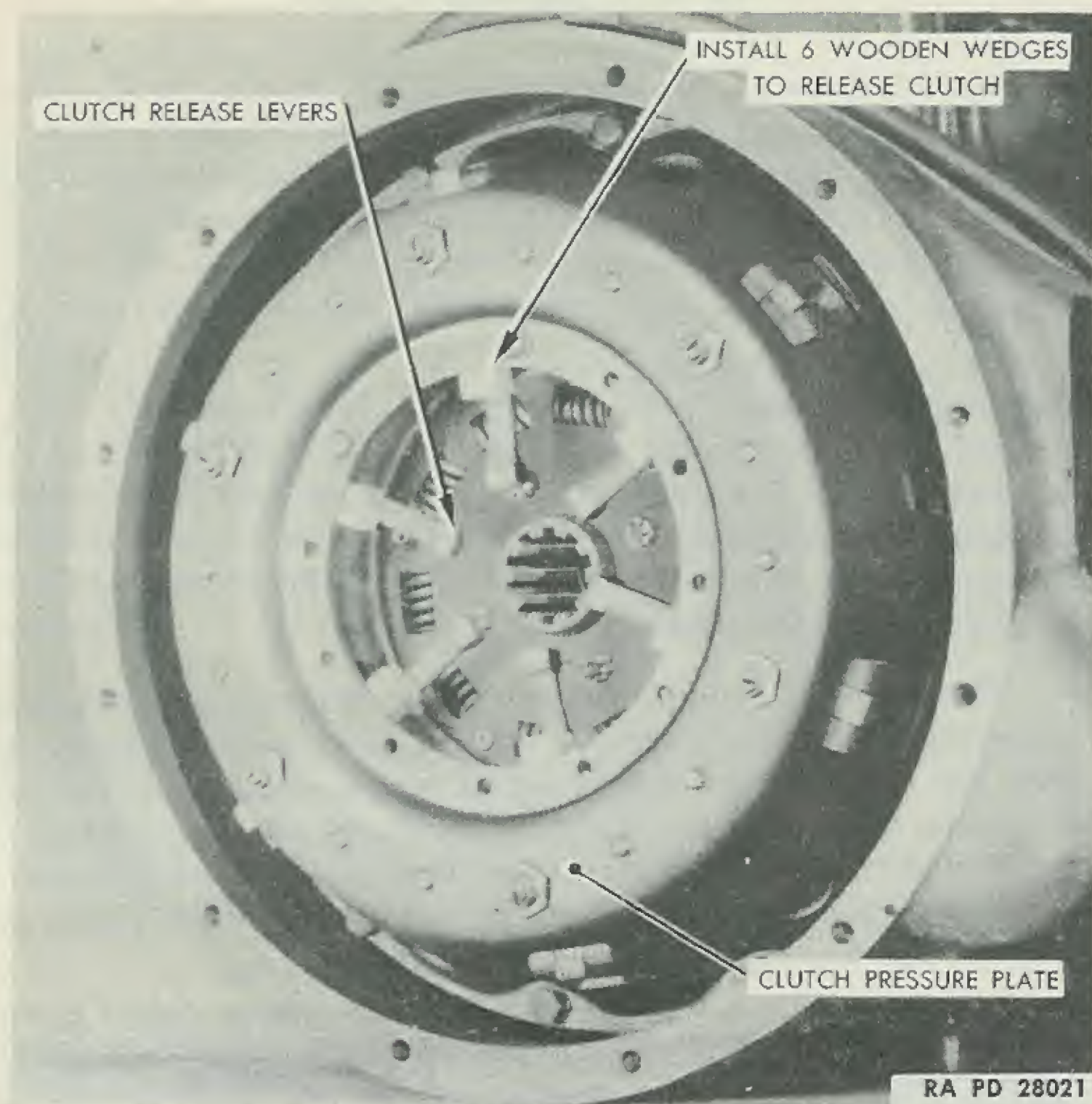


Figure 35 — Clutch Pressure Plate with Fingers Blocked Down

116. CONTROLS (figs. 34 and 46).

a. The clutch hydraulic control consists of the master cylinder (par. 120), slave cylinder (fig. 34) and the various hydraulic lines (par. 122) connecting these units.

117. MAINTENANCE.

a. Maintenance of the clutch consists of keeping the master cylinder reservoir full of fluid, regular inspection, linkage adjustment and lubrication.

118. ADJUSTMENT.

a. Remove the clevis pin from the clevis release lever (fig. 34). With the clutch hydraulic slave cylinder in release position, $\frac{1}{4}$ -inch movement of the clutch release lever should be possible before the

CLUTCH

clutch release fork contacts the release bearing. Adjust the length of the clutch slave cylinder clevis rod (fig. 34) until correct clearance is obtained. The clutch pedal pad in released position should have $\frac{1}{4}$ -inch free travel before there is contact with the master cylinder.

119. CLUTCH DISK AND PRESSURE PLATE (fig. 36).

a. **Description.** The clutch is a dry-type, single-plate clutch composed of two major units, the pressure plate (fig. 36) and the driven plate or disk. The drive plate or disk (fig. 36) has friction facings riveted to both sides.

b. Replacement.

(1) SPECIAL EQUIPMENT.

TOOL, clutch disk pilot

Six clutch finger wedges (fig. 35) (wooden wedges, 1-in. long, tapering from $\frac{5}{8}$ -in. to $\frac{7}{16}$ -in.).

(2) REMOVAL.

Remove the transmission from the vehicle (par. 128). Release the clutch by installing 6 wooden wedges between the clutch fingers and the pressure plate housing as shown in figure 35. Remove the 12 cap screws holding the pressure plate to the flywheel and remove the pressure plate (fig. 36) and the disk.

(3) INSTALLATION.

Reverse sequence of the steps of the removal procedure, using a clutch disk pilot tool to hold the disk in its correct position when the wedges are removed from under the fingers. Bleed the clutch hydraulic system (par. 123).

120. CLUTCH MASTER CYLINDER (fig. 46).

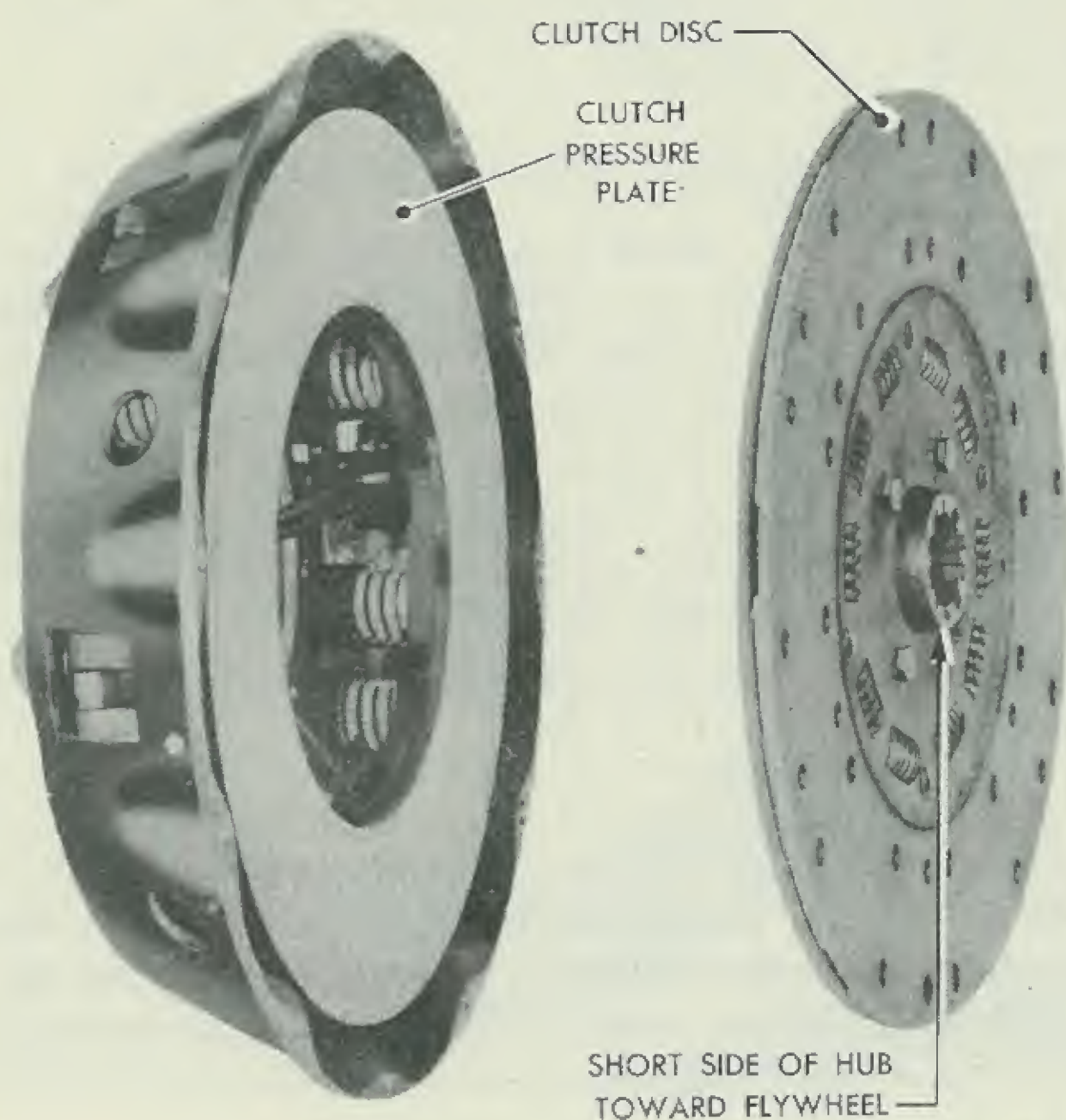
a. **Description.** The clutch master cylinder is located in the driver's compartment mounted on the bow above the steering column (fig. 46) and is actuated by the clutch pedal. The pressure applied to the hydraulic fluid in the master cylinder actuates the clutch slave cylinder (fig. 34).

b. Replacement.

(1) **REMOVAL.** Disconnect the hydraulic fluid line at the master cylinder. Remove the clutch pedal. Remove the mounting screws that secure the hydraulic cylinder to the mounting bracket and remove the master cylinder.

LIGHT ARMORED CAR M8

(2) **INSTALLATION.** Reverse sequence of the steps of the removal procedure. Bleed the clutch system (par. 123).



RA PD 28022

Figure 36 — Clutch Disk and Pressure Plate

121. CLUTCH SLAVE CYLINDER (fig. 34).

a. **Description.** The clutch slave cylinder is mounted on the left-hand side of the transmission (fig. 34) connected to the clutch release lever. The slave cylinder operates the clutch cross shaft to release the clutch.

b. Replacement of the Slave Cylinder.

(1) **REMOVAL.** Disconnect the hydraulic line from the slave cylinder. Remove clevis pin from clutch release shaft lever. Remove the 2 cap screws that hold the slave cylinder to the transmission and remove the slave cylinder.

(2) **INSTALLATION.** Reverse sequence of steps of the removal procedure. Adjust as outlined in paragraph 118. Bleed the hydraulic system as outlined in paragraph 123.

CLUTCH

122. HYDRAULIC LINES.

a. The various hydraulic lines used throughout the vehicle are either of standard tubing or standard flexible lines. In either case the lines are equipped with connections that permit the easy removal and replacement of any portion of the line. When installing new lines, make sure that the contour of the new line is the same as the original contour of the line being replaced. When the new line is installed, bleed the lines (par. 123).

123. BLEEDING HYDRAULIC LINES.

a. Remove filler plug from the master cylinder (fig. 46) and fill the reservoir with FLUID, brake, hydraulic. Remove dust cap and attach the standard bleeder tube to the bleeder valve (fig. 34) on the same cylinder. Place the end of the bleeder tube in a clear glass jar containing some hydraulic fluid. The end of the tube should be below the surface of the liquid. Unscrew the bleeder valve about $\frac{3}{4}$ turn. Pump clutch pedal slowly (this will force fluid through the lines) and continue to pump the clutch pedal until no more bubbles come out (fig. 47). When, with each stroke of the pedal, only fluid comes out, close the bleeder valve and replace the dust cap. The elbow at the top of the vertical line at the right-hand side of the fuel tank leading from the slave cylinder is provided with a bleeder valve. Bleed at this point after bleeding at the above cylinder as outlined above. CAUTION: The master cylinder reservoir must be kept filled with brake fluid during the bleeding operation to prevent any air from entering the system.

LIGHT ARMORED CAR M8

Section XX

PROPELLER SHAFTS AND UNIVERSAL JOINTS

	Paragraph
Propeller shafts and universal joints.....	124
Pillow block	125

124. PROPELLER SHAFTS AND UNIVERSAL JOINTS.

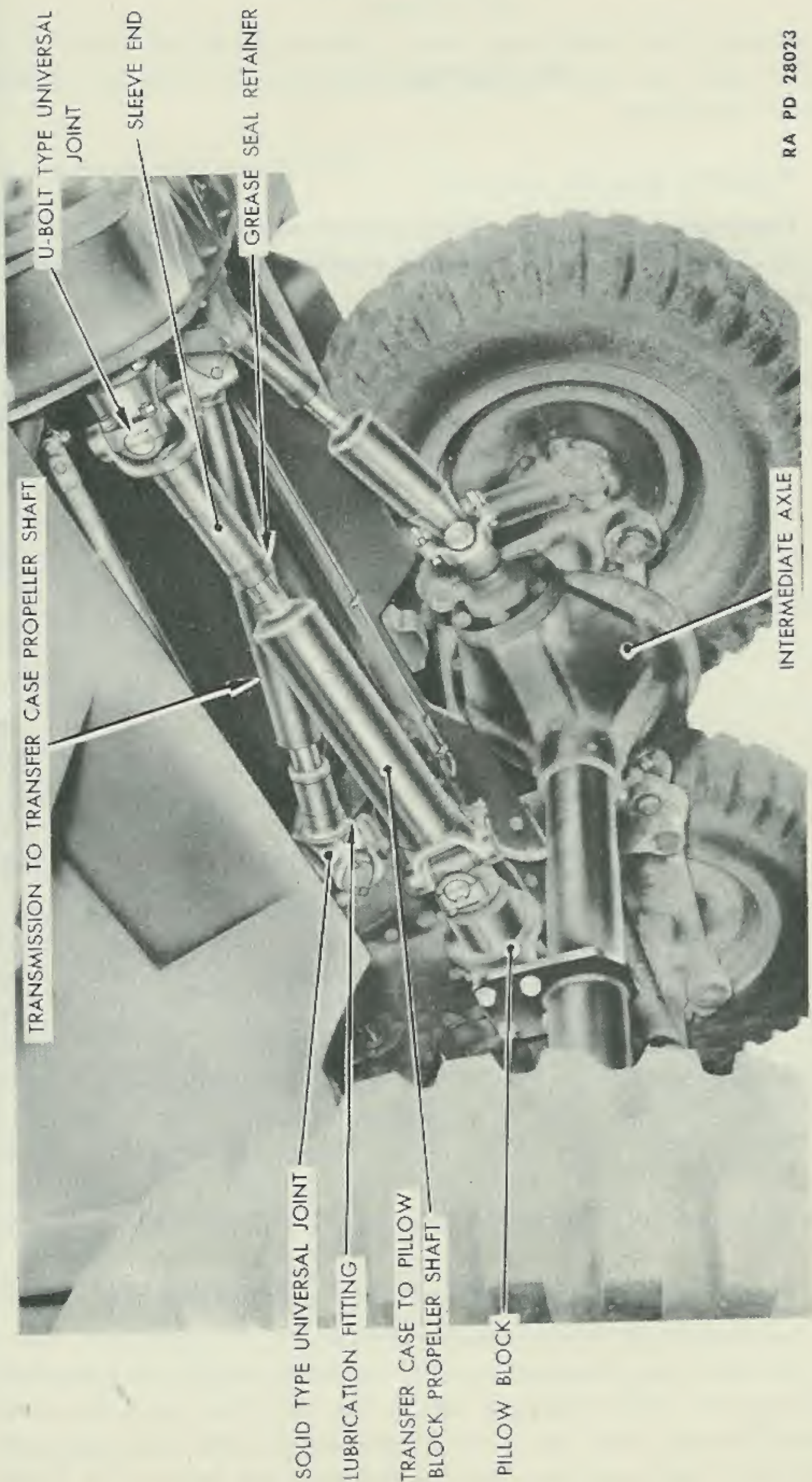
a. **Description.** Two types of propeller shafts and universal joints are used to transmit the power from the engine to the transfer case and to each of the 3 axles (fig. 37). On one type of universal joint, the bearings are held in place with U-bolts (fig. 37) (par. 124 b). On the second (solid yoke) type the bearings are held in place with a small plate at each bearing (fig. 37) (par. 124 c). There are 5 propeller shafts in all. Each propeller shaft is provided with a slip joint at the forward end, with the exception of the propeller shafts running from the transfer case to the transmission, and from the transfer case to the front axle where the slip joint is located at the rear. The power line to the rear axle consists of a propeller shaft running from the transfer case to a pillow block (fig. 37) on the intermediate axle and another propeller shaft running from the pillow block to the rear axle.

b. **Replacement of Propeller Shafts with U-bolt Type Universal.** Remove 8 nuts and the 4 U-bolts that hold the universal joint bearings to the driving or driven yokes. The slip joint in the propeller shaft will permit the shaft to be removed. To reinstall these propeller shafts, reverse the above procedure.

c. **Replacement of Propeller Shafts with Solid Yoke-type Universal Joint.**

(1) **REMOVAL.** Bend down the 8 locking lugs on the 4 lock plates on each end of the propeller shaft. Remove the 4 cap screws, 2 locking lugs and the 2 plates opposite each other on one yoke. Support the yoke; then push on the exposed face of one bearing until the opposite bearing assembly comes out. Push on the exposed end of the trunnion until the other bearing assembly comes out. Repeat the same operation on the other yoke; then slide the trunnion to one side of the yoke and remove propeller shaft at that end. Repeat the above procedure at the opposite end of the

PROPELLER SHAFTS AND UNIVERSAL JOINTS



RA PD 28023

Figure 37 — Under Side of Chassis as Viewed from Front of Intermediate Axle

LIGHT ARMORED CAR M8

shaft. Remove the driving and driven yokes and reinstall them on the propeller shaft just removed. Reinstall the propeller shaft by reversing the above procedure.

125. PILLOW BLOCK (fig. 37).

a. **Description.** The pillow block located on top of the intermediate axle (fig. 37) is a part of the drive line, running from the transfer case to the rear axle.

b. **Replacement.** Disconnect the 2 universal joints (par. 124 b) at the pillow block. Remove the 4 cap screws from the pillow block (fig. 37) and remove the pillow block. Reverse the sequence of steps in the removal procedure to reinstall the pillow block.

Section XXI

TRANSMISSION

	Paragraph
General description and data	126
Shift mechanism	127
Transmission replacement	128

126. GENERAL DESCRIPTION AND DATA.

a. **Description.** The engine is equipped with a Warner Gear Company four-speed transmission fitted for remote control. The transmission is of the synchronized, selective sliding gear type.

b. Data.

Ratios:

First gear	6.499 to 1.0
Second gear	3.543 to 1.0
Third gear	1.752 to 1.0
Fourth gear	1.000 to 1.0
Reverse	6.987 to 1.0

127. SHIFT MECHANISM.

a. The actual gear shift pattern (fig. 7) is the same as used on most trucks equipped with four-speed transmissions. However, since the transmission of the Light Armored Car M8 is located in the rear of the vehicle and the gearshift lever is in the driver's compartment, a means of transmitting the movement of the gearshift lever to transmission is provided. This is accomplished by means of shafts equipped with universal joints (figs. 38 and 40). Crosswise movement of the gearshift lever rotates this shaft and selects the correct rail in the gearshift housing. Fore and aft movement of the gearshift lever results in a fore and aft movement of this shaft and causes the sliding gear to move into the desired position.

128. TRANSMISSION REPLACEMENT.

a. **Removal.** The transmission can be removed or installed without removing the engine as follows: Jack up the rear end of the hull; disconnect and lower the rear end of the propeller shaft running from the transmission to the transfer case; remove the clutch slave cylinder (par. 121 b (1)) from the transmission, and disconnect the clevis from the

LIGHT ARMORED CAR M8

lever; remove the clip on the top of the transmission that holds the hydraulic line running to the slave cylinder; remove the 12 clutch housing flange cap screws, and slide the transmission out.

b. Installation. Reverse the sequence of steps in the removal procedure, except that it will be necessary to put transmission in gear so that transmission spline shaft can be turned to line up with the splines in the clutch disk. **CAUTION:** When reassembling, be sure that the radio bond strap on the upper right-hand flange bolt does not get caught between the flywheel housing and the clutch housing flange.

Section XXII

TRANSFER CASE

	Paragraph
General description and data	129
Controls	130
Replacement of transfer case.....	131

129. GENERAL DESCRIPTION AND DATA.

a. **Description.** The Light Armored Car M8 is equipped with a Warner Gear Company two-speed transfer case provided with a front axle throwout (fig. 8). The transfer case (fig. 38) is located on the under side of the cross member midway between the front and intermediate axles.

b. Data.

Ratios:

High gear	1.000 to 1.0
Low gear	1.956 to 1.0

130. CONTROLS.

a. Complete description and instructions for the operation of the transfer case controls (fig. 8) is given in paragraph 6 c (8) and (9).

131. REPLACEMENT OF TRANSFER CASE.

a. **Removal.** Remove the clevis pins from the 2 front axle engaging rod clevises, 1 at the back and 1 at the front of the transfer case. Remove the 2 clevis pins from the 2 hand brake clevises at the hand brake drum (fig. 43). Disconnect the knurled nut from the speedometer cable where it connects to the speedometer drive unit (fig. 38) on the transfer case. Remove clip which holds cable to transfer case and move cable to one side. Disconnect the 4 propeller shafts from the transfer case (par. 124). Place a jack under the center of the transfer case so as to support the weight of the case. Remove the lock wire and the 2 mounting cap screws from each side of the transfer case. Lower jack and remove the transfer case.

b. **Installation.** Reverse the sequence of the steps in the removal procedure and replenish the transfer case oil if required.

LIGHT ARMORED CAR M8

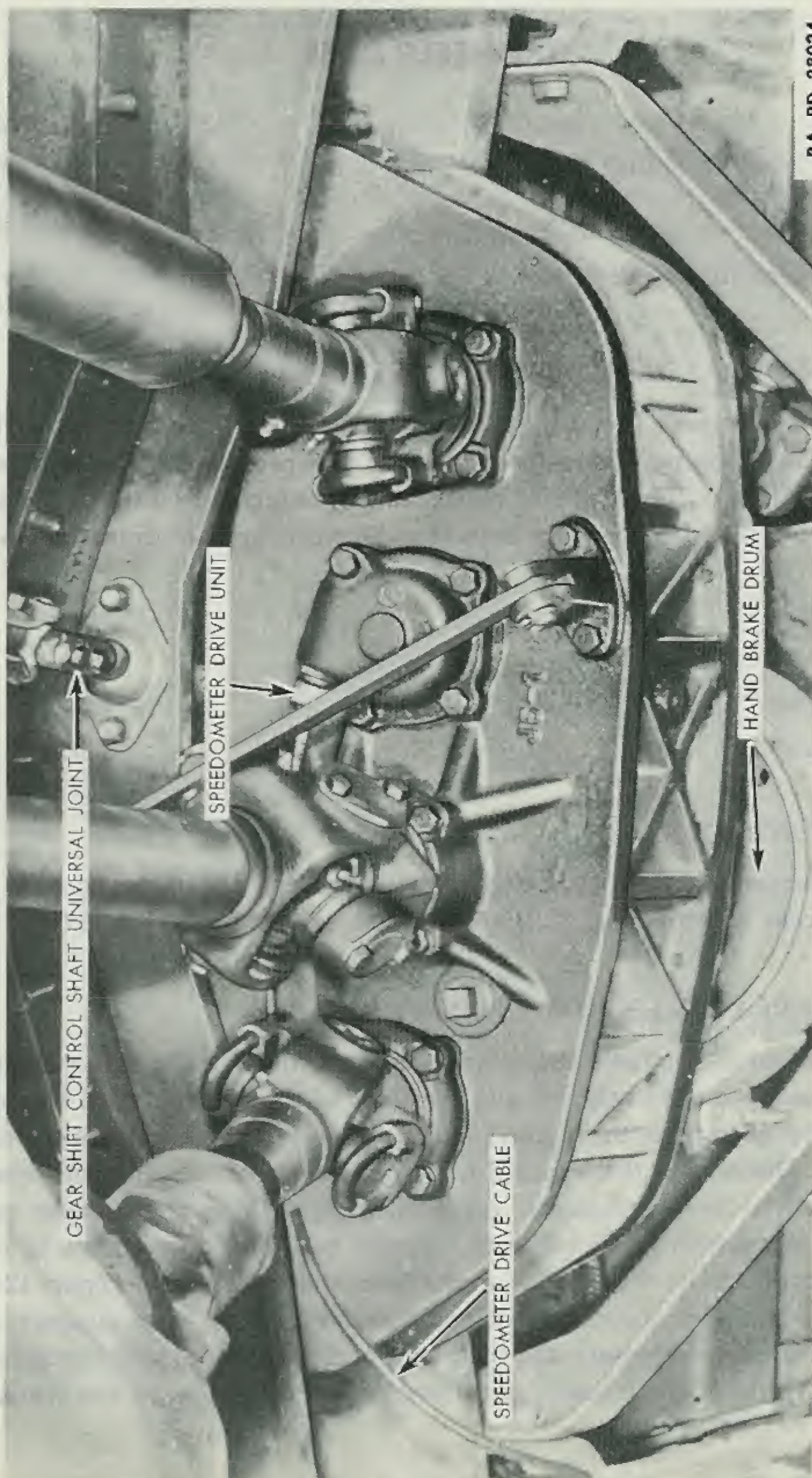


Figure 38 — Transfer Case

Section XXIII

AXLES

	Paragraph
General description and data.....	132
Wheel alinement	133
Front axle	134
Front axle replacement.....	135
Rear and intermediate axles.....	136
Rear and intermediate axle replacement.....	137

132. GENERAL DESCRIPTION AND DATA.

a. The three axles consist of Ford standard 1½-ton rear axle housings and differentials. The housing tubes, axle shafts, and hubs are longer than standard. The axles have a ratio of 6.66 to 1.0.

133. WHEEL ALINEMENT.

a. Specifications.

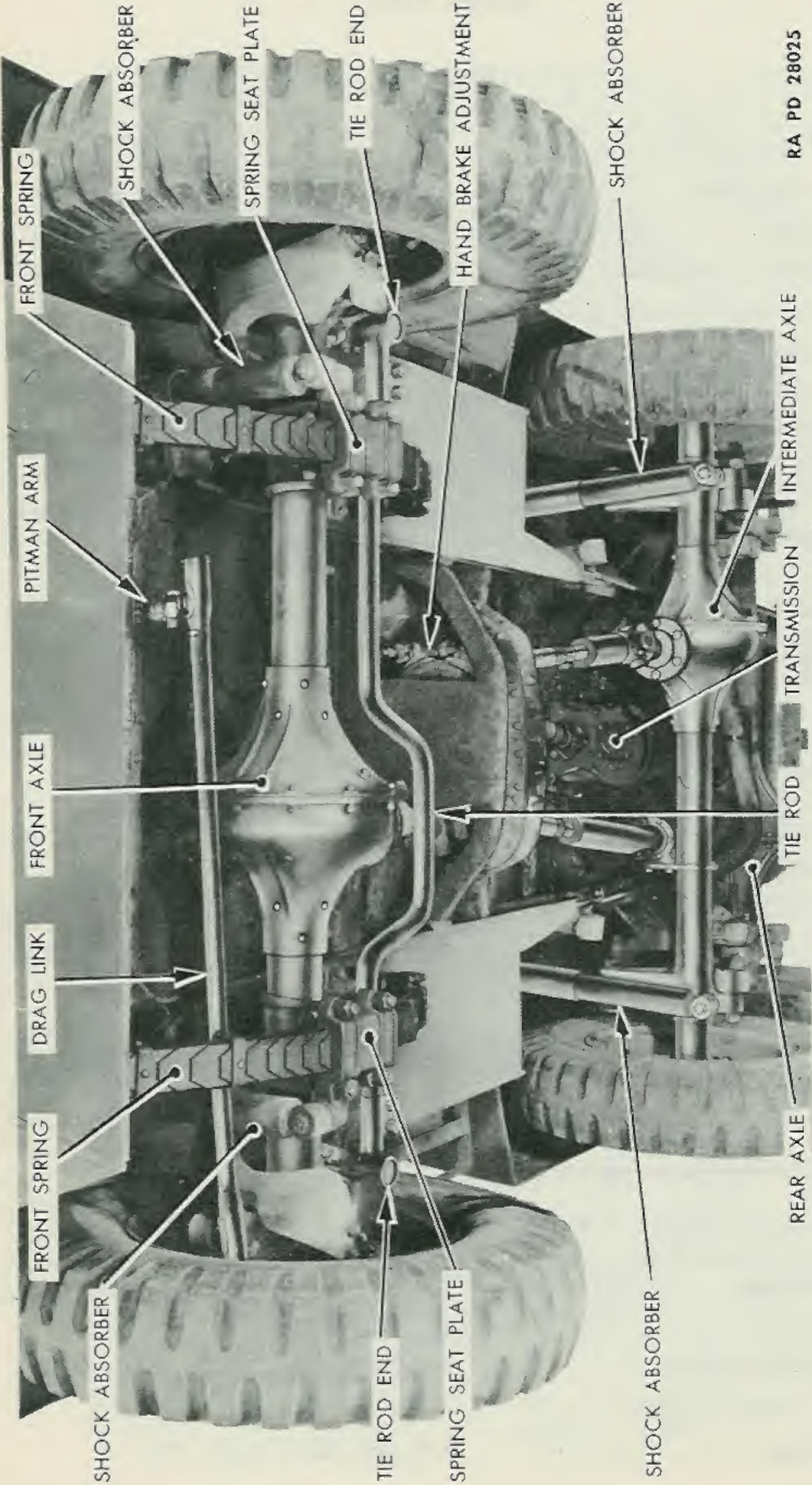
Caster	2 deg
Camber	¾ deg
Toe-in	1/16 in.
Side inclination of spindle pin.....	8 deg
Wheel base:	
Front to intermediate.....	80 in.
Front to rear axle.....	128 in.
Tread:	
Front	76 in.
Rear	76 in.
Turning radius	27.5 ft

b. Trouble Shooting.

(1) VEHICLE PULLS TO ONE SIDE.

Probable Cause	Probable Remedy
Underinflation.	Inflate tires to the correct pressure (par. 148).
Tight wheel bearings.	Adjust or replace wheel bearings (par. 151).
Brake drag.	Adjust brakes (par. 159).
Incorrect toe-in.	Adjust tie rod (par. 134 c (3)).

LIGHT ARMORED CAR M8



RA PD 28025

Figure 39 — Under Side of Hull, Showing Axles

AXLES

Probable Cause	Probable Remedy
Bent steering arm.	Replace.
Bent drag link.	Replace (par. 147 b).
Unequal caster.	
Uneven camber.	
(2) JERKY STEERING.	
Steering gear roller not on high point of worm.	Adjust (par. 147 a).
Dragging brakes.	Adjust brakes (par. 159).
Bent wheel.	Change wheel (par. 150).
Bumpy tire.	Change tire (par. 149).
(3) HARD STEERING.	
Lack of lubrication.	Lubricate vehicle.
Underinflation.	Inflate tires to the correct pressure (par. 148).
Incorrect toe-in.	Adjust tie rod (par. 134 c (3)).
Tight spindle bearings.	Adjust spindle bearings.
Too much caster.	
(4) WANDER.	
Underinflation.	Inflate tires to the correct pressure (par. 148).
Incorrect toe-in.	Adjust tie rod (par. 134 c (3)).
Loose wheel bearings.	Adjust (par. 151).
Loose steering connections.	Tighten.
Unequal or too little caster.	
Too little or negative camber.	
(5) ROAD SWAY.	
Underinflation.	Inflate tires to the correct pressure (par. 148).
Faulty shock absorbers.	Replace (par. 143 c).
Worn spring shackles.	Replace shackles (par. 140).
Broken spring tie bolt.	Replace.
Broken spring leaf.	Replace.

LIGHT ARMORED CAR M8

Probable Cause

Probable Remedy

(6) SHIMMY (LOW SPEED).

Loose steering connections.	Tighten.
Loose spring mountings.	Tighten.
Loose wheel bearings.	Adjust (par. 151).
Loose spindle bearings.	Adjust.
Too little caster.	

(7) WHEEL TRAMP (HIGH SPEED).

Underinflation.	Inflate tires to the correct pressure (par. 148).
Unbalanced wheel.	Balance.
Not enough caster.	
Incorrect toe-in.	Adjust tie rod (par. 134 c (3)).
Cupped tires.	Replace (par. 149).
Incorrect shock absorber adjustment.	Adjust (par. 143 b).

134. FRONT AXLE.

a. **Description.** The front axle on the Light Armored Car M8 at the driver's option provides a means of driving the front wheels. The axle is provided with a differential, split type axle housings, and detachable axle housing outer ends which are used for mounting the special steering knuckle assemblies. The caster, camber, king pin inclination and turning radius are established in manufacture and are not adjustable. The toe-in is adjusted by regulating the length of the tie rod (par. 134 c (3)).

b. Axle Shaft Replacement.

(1) **REMOVAL.** Remove the wheel and brake drum (par. 151 b (1)). Disconnect the flexible hydraulic brake line at the bracket, mounted on the axle housing. Remove 10 cap screws from the brake housing plate (fig. 45) and remove brake plate and spindle. Slip the axle shaft from the axle housing.

(2) **INSTALLATION.** Reverse the sequence of steps in the removal procedure until the brake plate is installed; then continue installation as outlined in paragraph 151 b (2) including bleeding of the hydraulic lines (par. 164).

AXLES

c. Tie Rod (fig. 39).

(1) **DESCRIPTION.** The front axle of the Light Armored Car M8 is equipped with a tubular tie rod with ball joint ends. The left-hand tie rod end is provided with a right-hand thread (12 to the inch). One turn of the left-hand tie rod end shortens the length of the tie rod 0.083 inch. The right-hand tie rod end is provided with a right-hand thread (14 to the inch). One turn of the right-hand tie rod end shortens or lengthens the length of the tie rod 0.071 inch. Toe-in adjustment of the front wheels is accomplished by adjusting the length of the tie rod (par. 134 c (3)).

(2) **REPLACEMENT.** Remove the cotter pins and castellated nuts that hold the ball joints to the spindle arms. Remove the rod as an assembly by pulling the ball from the spindle arms. To reinstall, reverse the sequence of steps in the above procedure.

(3) **ADJUSTMENT (TOE-IN).** Check the toe-in of the front wheels to determine the amount of change in the tie rod length required to establish a toe-in of $\frac{1}{16}$ inch. Usually the toe-in of the front wheels will not change except as the result of some mishap that bends either on both of the spindle arms or the tie rod. The combined toe-in of the 2 front wheels increases or decreases approximately the same amount as any change made in the length of the tie rod. Lengthening the tie rod increases the toe-in. Shortening the tie rod decreases the toe-in. Disconnect either end of the tie rod from its spindle arm. Loosen the clamp bolt and turn the tie rod on either or both ends the amount required to obtain the desired length for the tie rod. Since the tie rod is formed to clear the differential, only complete turns of the tie rod ends are possible. However, since the 2 ends have a different number of threads per inch, any length desired is possible. When the correct adjustment is obtained, tighten the clamp bolt and reinstall the ball in the spindle arm and lock in place.

135. FRONT AXLE REPLACEMENT.

a. **Removal.** Disconnect pitman arm (fig. 39) from the drag link. Disconnect hydraulic brake line from junction on axle housing. Remove the 4 nuts, lock washers and U-bolts from the universal joint at the axle and disconnect the universal joint. Disconnect the 2 front shock absorbers at the axle housing. Remove the 2 front springs as outlined in paragraph 138 b (1). Raise the vehicle and roll the axle out from under the vehicle.

b. **Installation.** Reverse the sequence of steps in the removal procedure and bleed the hydraulic brake lines (par. 164).

LIGHT ARMORED CAR M8

RA PD 28037

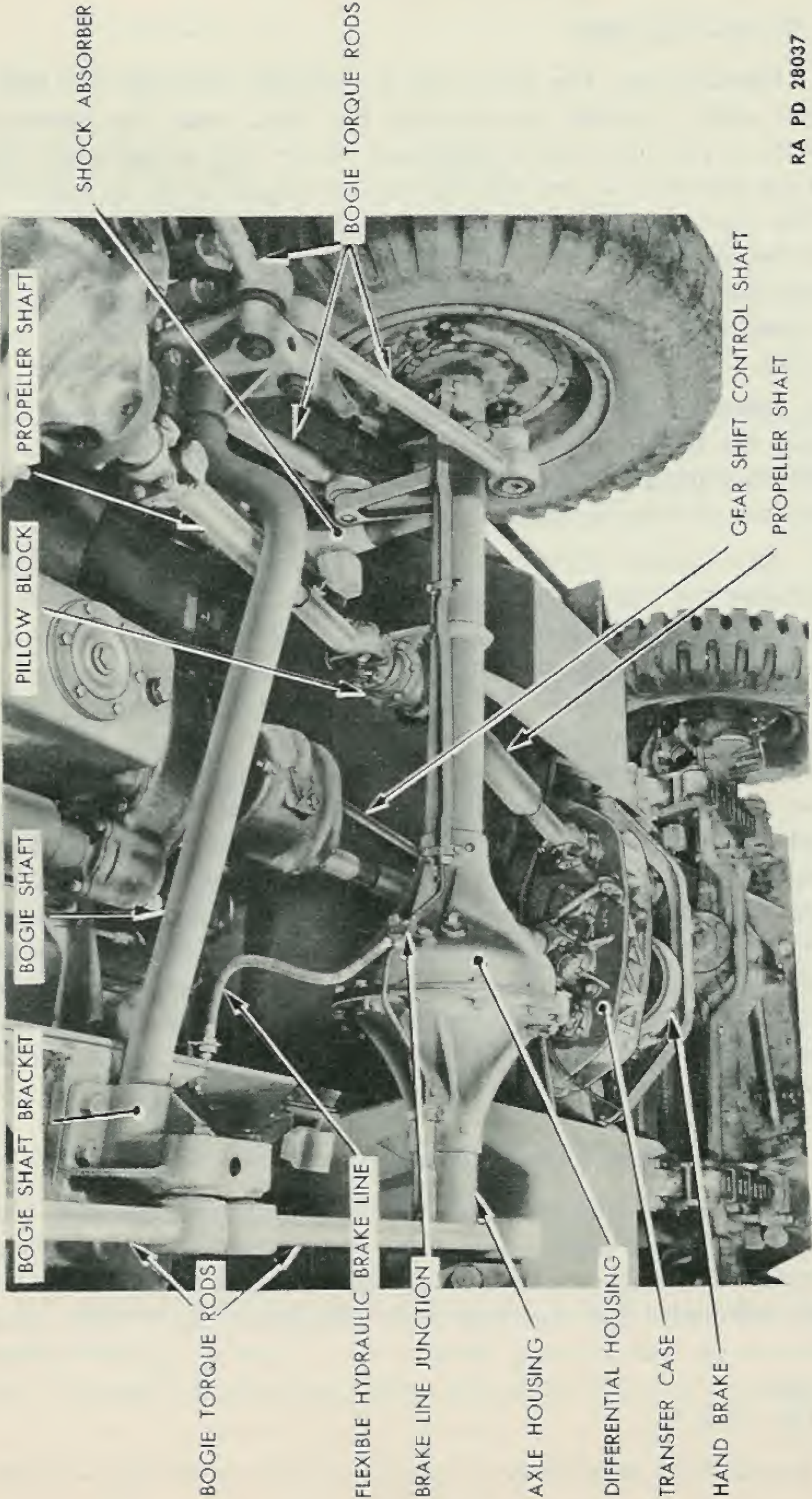


Figure 40 — Under Side of Hull as Viewed from Left Rear

AXLES

136. REAR AND INTERMEDIATE AXLES.

a. **Description.** The rear and intermediate axles are of special design following the general construction of standard Ford truck axles with spiral level drive gears and straddle mounted pinion. The axles are the full-floating type in which the load is carried on the axle housings rather than the axle shafts.

b. Axle Shaft Replacement.

(1) **REMOVAL.** Remove the 8 nuts, lock washers and wedges from the axle shaft drive flange (fig. 42). Tighten down the 2 remaining cap screws to force the axle shaft part way out of the axle housing. Pull the axle shaft the rest of the way out of the axle housing.

(2) **INSTALLATION.** Reverse the sequence of steps in the removal procedure, using a new gasket under the axle shaft flange.

137. REAR AND INTERMEDIATE AXLE REPLACEMENT.

a. **Removal.** Disconnect the 4 brake hydraulic lines at the flexible tube located on the bogie torque rods (fig. 40) and from the brake line junction on the differential housing (fig. 40). Remove the propeller shaft (par. 124 b) (fig. 40) that runs from the pillow block to the rear axle. Disconnect the 2 propeller shafts (par. 124 b) at the intermediate axle. Remove the 4 shock absorbers (fig. 40). Raise the vehicle until the weight is off the rear and intermediate axles. Disconnect the 8 bogie torque rods (fig. 40) at the axles. Raise the vehicle high enough to clear the wheels, and roll the axles out from under the vehicle.

b. **Installation.** Reverse the sequence of steps in the removal procedure and bleed the brake hydraulic lines.

LIGHT ARMORED CAR M8

Section XXIV

SPRINGS, BOGIES, AND SHOCK ABSORBERS

	Paragraph
Front springs	138
Rear springs	139
Spring shackles	140
Bogie	141
Bogie bracket	142
Shock absorbers	143

138. FRONT SPRINGS (fig. 39).

a. **Description.** The 2 front springs are the semielliptic type. The top leaf has an eye formed at each end for the shackle bolt. The front springs are secured to the front axle spring seat by U-bolts and a spring seat plate (fig. 39). The springs are shackled at the rear to spring hangers mounted on the hull.

b. **Replacement of a Front Spring.**

(1) **REMOVAL.** Raise the front end of the vehicle until the spring is in a released position. Remove the 4 U-bolt nuts and remove the spring seat plate (fig. 39). Remove the front and rear spring shackle pins; see paragraph 140 b and remove the spring.

(2) **INSTALLATION.** Reverse sequence of the steps of the removal procedure. Make certain the spring seat plate centering hole is in line with the spring tie bolt.

139. REAR SPRINGS.

a. **Description.** The rear springs are the semielliptic type. The springs are anchored in the center (fig. 42) to the bogie bracket; the ends float in spring guides mounted on the axle housing.

b. **Replacement of Rear Springs.**

(1) **REMOVAL.** Raise the back end of the vehicle until the spring is in a fully released position. Disconnect the hydraulic brake lines. Remove the torque rods nuts and remove the rods (fig. 40). This will let the rear axles shift, allowing the spring end to slide out of the spring guides. Remove the spring U-bolt nuts (fig. 42) and remove the spring.

(2) **INSTALLATION.** Reverse sequence of the steps of the removal procedure. Bleed the hydraulic system as outlined in paragraph 164.

SPRINGS, BOGIES, AND SHOCK ABSORBERS

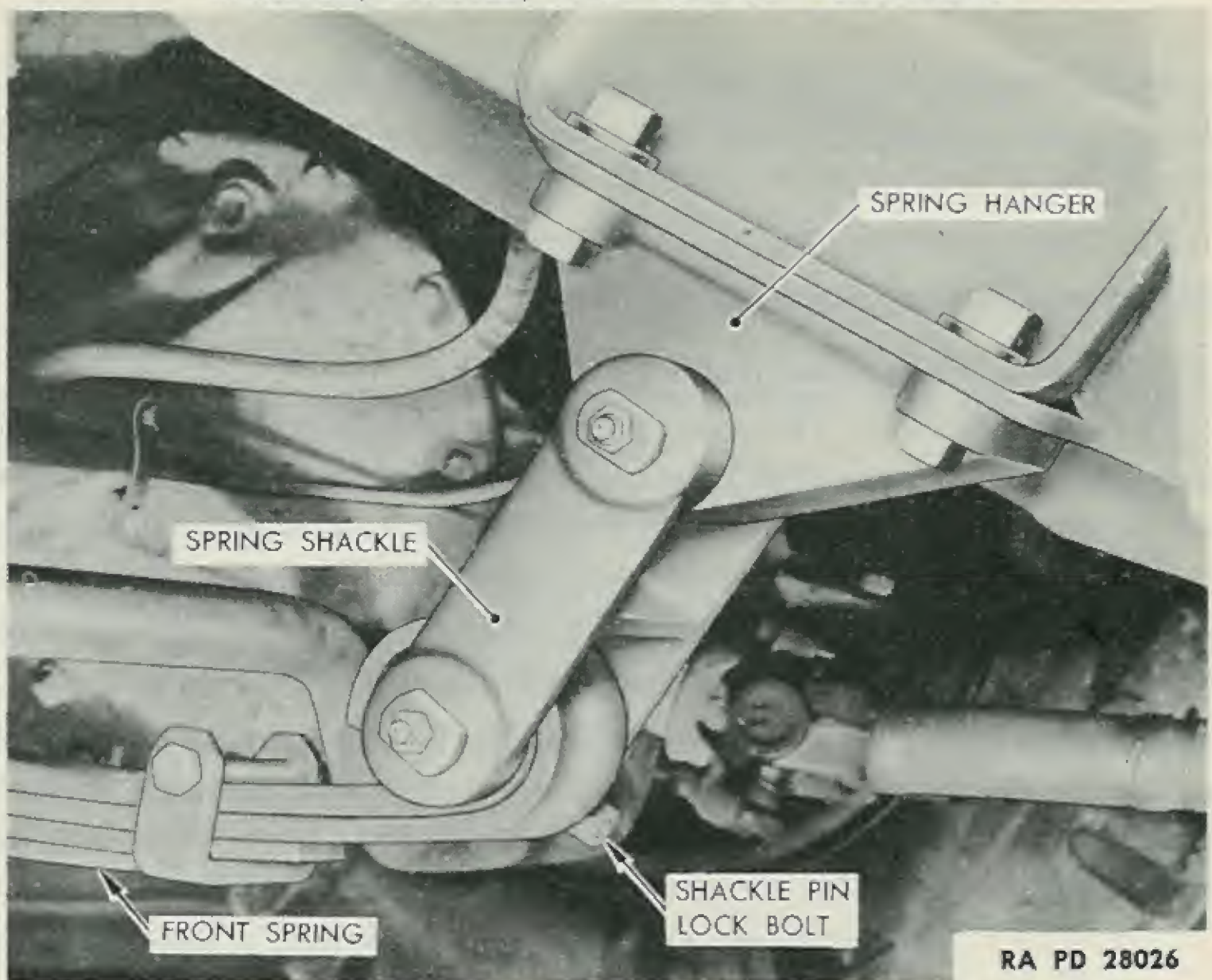


Figure 41 — Spring Shackle and Hanger

140. SPRING SHACKLES (fig. 41).

a. **Description.** A spring shackle is used at the rear end of the front spring connecting the spring to a spring hanger (fig. 41) mounted on the hull.

b. **Replacement of the Shackle.** Raise the vehicle, lifting the weight from the spring shackle. Remove the nuts from the shackle pin lock bolts (fig. 41) and remove the lock bolts. Remove the 2 shackle pins and remove the shackle. To reinstall, reverse sequence of the steps of the removal procedure.

141. BOGIE.

a. **Description.** The bogie is the vehicle's rear supporting unit. The bogie allows the wheels to rise or lower independently of each other as they pass over irregularities in the ground surface.

b. **Bogie Shaft Bearing Replacement (fig. 40).**

(1) **REMOVAL.** Remove 4 cap screws from the bogie shaft bearing cover (fig. 42) and remove the cover. Bend the bogie shaft lock washer lugs back from the lock nut and remove the lock nut. Remove the bogie shaft bearing adjusting nut. Raise the vehicle to release the weight from

LIGHT ARMORED CAR M8

the bogie bearing. Pull out on the bearing and remove. To remove the inner bearing, remove the spring as outlined in paragraph 139 b (1). Slide the bogie bearing housing off the shaft and remove the inner bearing.

(2) **INSTALLATION.** Reverse sequence of the steps of the removal procedure and bleed the hydraulic brake system (par. 164).

c. Bogie Torque Rods (fig. 40).

(1) **DESCRIPTION.** The rear and the intermediate axles are each equipped with 2 torque rods (one on each side) (fig. 40). These torque rods maintain the distance between these axles and their relationship to the hull. All of the driving force of either axle is transmitted to the hull through these torque rods and the bogie bracket (fig. 42).

(2) REPLACEMENT OF THE TORQUE RODS.

(a) **Removal.** Disconnect the hydraulic brake lines at brake line junction on the differential (fig. 40). Remove the nuts and lock washers from the torque rod bearing. Pull the torque rods from the mounting bracket and remove.

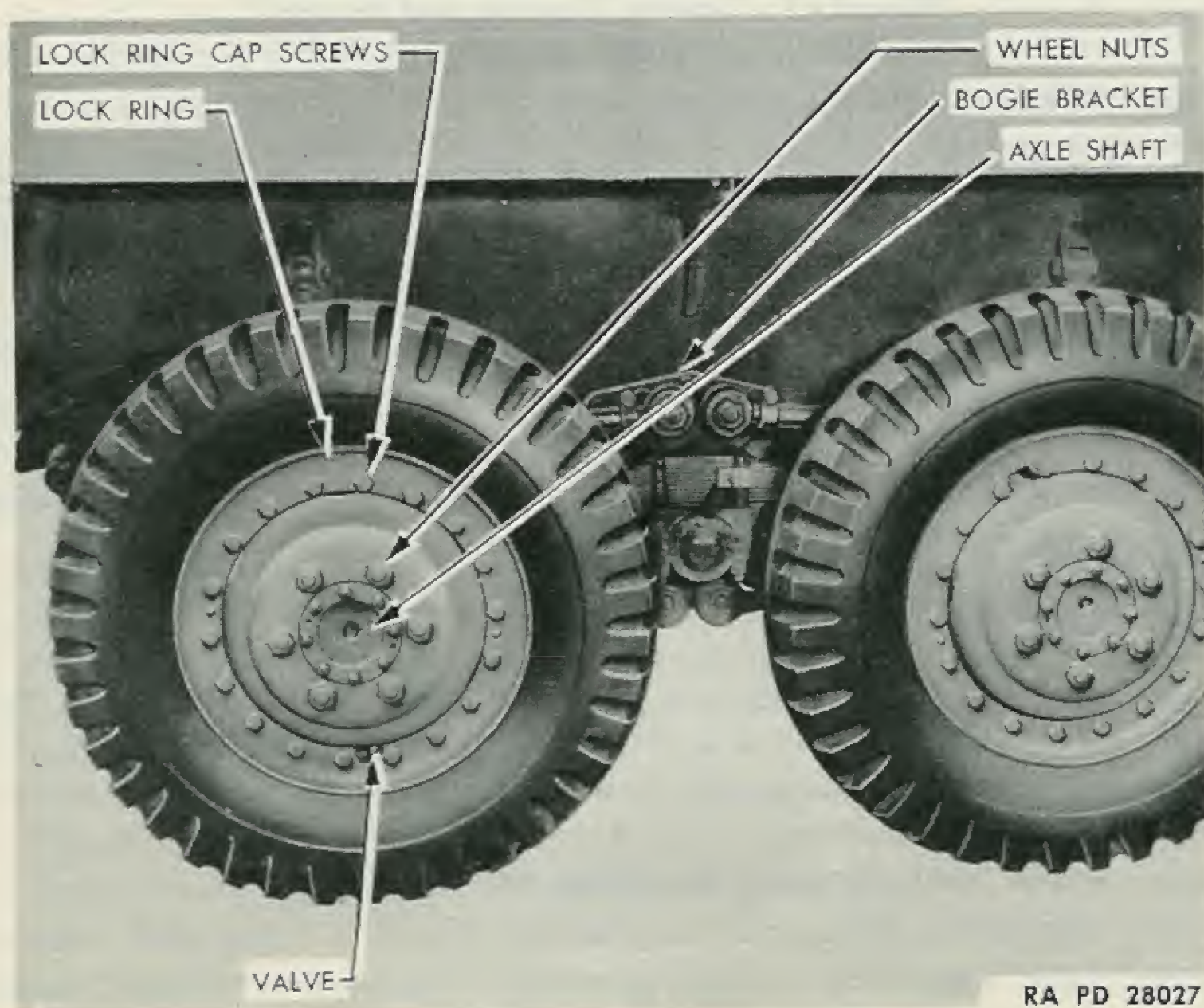


Figure 42 — Rear and Intermediate Axles, Showing Wheels and Tires

SPRINGS, BOGIES, AND SHOCK ABSORBERS

(b) *Installation.* Reverse sequence of the steps of the removal procedure. Bleed the hydraulic brake system as outlined in paragraph 164.

142. BOGIE BRACKET (fig. 42).

a. **Description.** The entire bogie, including the rear and intermediate axles are mounted on 2 bogie brackets, one on each side of the hull (fig. 42). The torque rods (par. 141) pivot from the bogie shaft bracket which is secured to the bogie bracket.

b. Replacement of the Bogie Bracket.

(1) **REMOVAL.** Remove the spring as outlined in paragraph 139 b (1). Remove the 6 cap screws that hold the bogie shaft bracket (fig. 40) to the bogie bracket. Remove the cotter pins and nuts that hold the bogie bracket to the hull (fig. 42) and remove the bracket.

(2) **INSTALLATION.** Reverse sequence of the steps of the removal procedure.

143. SHOCK ABSORBERS.

a. **Description.** A Gabriel direct-acting shock absorber is used on both sides of each axle. The top of each shock absorber is connected to a hull bracket; the lower end of the front shock absorber is connected to the spring plate (fig. 39). The lower end of the 4 rear shock absorbers is secured to the spring guides.

b. **Adjustment.** Disconnect the lower end of the shock absorber and push the unit together to engage the adjusting key. When the key is engaged, turn the lower half of the shock absorber clockwise until the limit of the adjustment is reached. Holding the unit together to keep the adjusting key still in the slot, turn the lower end of the shock absorber back (counterclockwise) 2 turns. This will establish the average adjustment. Turning the adjustment to the right or clockwise gives a firmer control for rough terrain; turning the adjustment counterclockwise establishes a softer control.

c. **Replacement of the Shock Absorber.** Remove the cotter pins, nuts and bolts from the shock absorber mounting brackets at both ends. Remove the shock absorber. To reinstall, reverse the sequence of the steps of the removal procedure.

LIGHT ARMORED CAR M8

Section XXV

STEERING GEAR

	Paragraph
Description and data	144
Steering gear replacement	145
Pitman arm	146
Drag link	147

144. DESCRIPTION AND DATA.

a. The steering gear is a Gemmer model 400 with a special housing and roller shaft. The steering gear is of the worm and roller type, having a ratio of 24.4 to 10. The steering wheel is the 3-spoke type, 17¾ inches in diameter.

145. STEERING GEAR REPLACEMENT.

a. **Removal.** Remove the nut and lock washer from the roller shaft at the pitman arm. Remove the pitman arm, using a pitman arm puller. Remove 4 cap screws and lock washers that hold the steering column to the hull floor from underneath the hull. Remove the steering wheel nut. Remove the steering wheel, using a steering wheel puller. Remove the 4 cap screws and lock washers that hold the steering column to the brackets inside of the hull (fig. 43). Remove the 2 cap screws and clamp (fig. 43) from the bottom edge of the instrument panel. Lift the steering column from the hull.

b. **Installation.** Reverse sequence of the steps of the removal procedure.

146. PITMAN ARM (fig. 39).

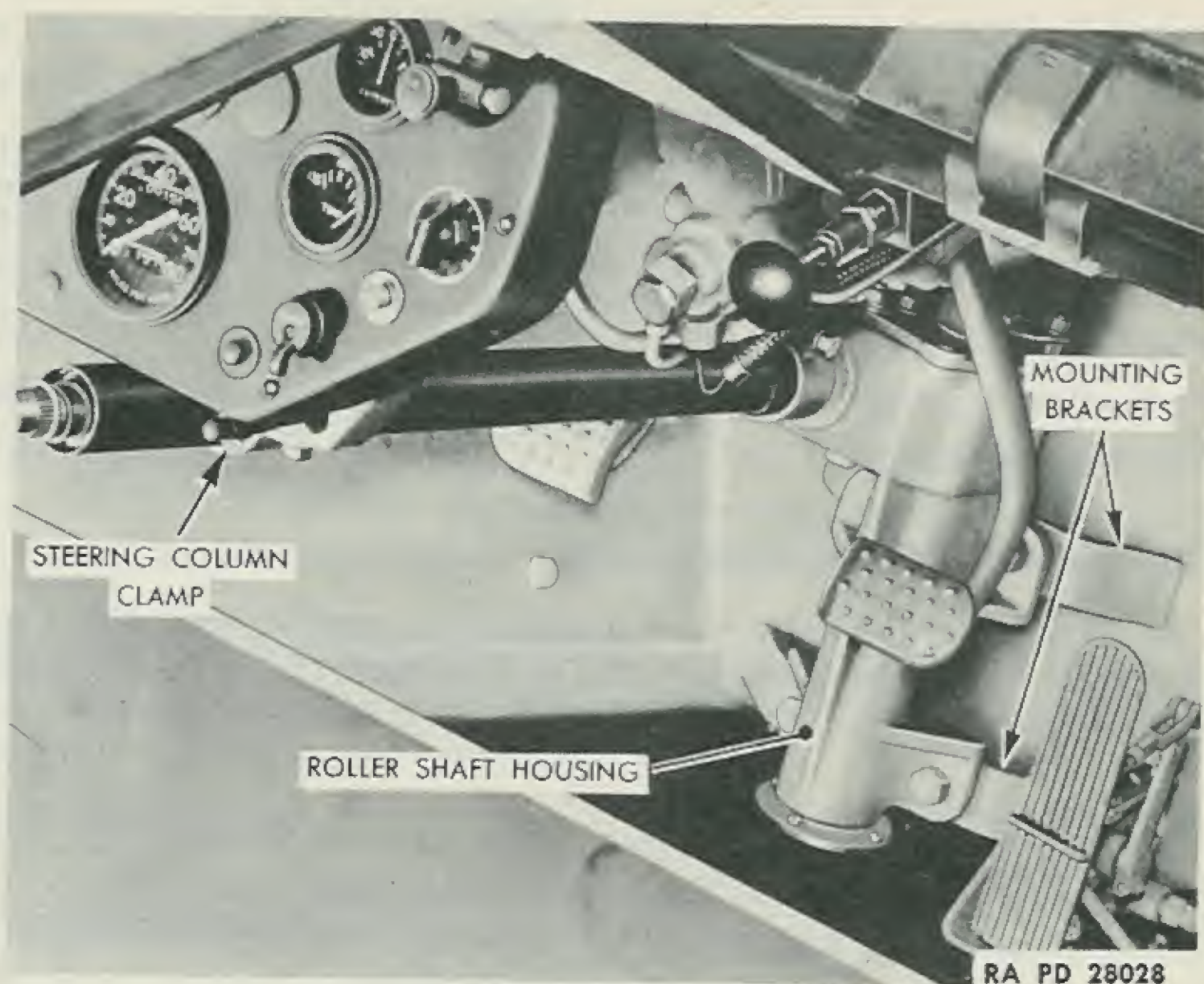
a. **Description.** The pitman arm (fig. 39) fits on a splined taper on the steering gear roller shaft. The pitman arm is connected to the drag link (fig. 39) by means of a ball and socket joint.

b. **Replacement.** Remove the cotter pin from the end of drag link (fig. 39). Unscrew plug from the end of drag link and remove spring, concave washer and grease seal. Lift drag link off pitman arm. Remove the nut holding the pitman arm to the roller shaft and pull the pitman arm, using a suitable puller. To reinstall, reverse sequence of steps of the removal procedure.

147. DRAG LINK (fig. 39).

a. **Description.** The drag link is provided with a ball socket on each end (fig. 39) and transmits the movement of the pitman arm to the steering arm at the right-hand spindle. The steering gear is designed so as

STEERING GEAR

*Figure 43 — Steering Gear*

to have less lash between the worm and roller in the straight ahead position. This, in a measure, prevents the irregularities of the road from changing the direction of the front wheels when traveling straight ahead and reduces the possibility of bind in the steering gear on turns. The length of the drag link is not adjustable and the relationship between the steering gear and the front wheels cannot change except as the result of some mishap. The most probable cause of a change in the relationship between the steering gear and the front wheels would be the bending or distortion of either the drag link, the pitman arm or the spindle arm. If, when the vehicle is traveling straight ahead, the steering gear roller is not on the high point of the worm, one or several of the above parts are at fault and must be straightened or replaced. When the steering gear roller is on the high point of the worm, one spoke of the steering wheel will be pointing straight back.

b. Replacement. Remove left front wheel (par. 150). Remove the cotter pin from the end of the drag link. Unscrew the plug from the end of the drag link and remove the spring, concave washer and grease seal. Repeat same operation at the other end of drag link. Lift drag link off the pitman arm and the steering arm. To reinstall the drag link, reverse sequence of the steps of the removal procedure.

LIGHT ARMORED CAR M8

Section XXVI

WHEELS AND TIRES

	Paragraph
Description and data	148
Tire replacement	149
Wheel replacement	150
Front wheel bearings	151
Rear wheel bearings	152

148. DESCRIPTION AND DATA.

a. **Description.** The tires are a pneumatic combat type with a non-directional tread. The wheels are the divided rim type. A lock ring holds the tires on the rim.

b. **Tabulated Data.**

(1) **WHEELS:**

Type	Firestone combat rim
Number used	6
Diameter	20 in.
Rim width and type	Divided rim, 6.00 combat type
Offset	5 3/8 in.
Bolt circle	8 3/4 in.

(2) **TIRES:**

Type	Firestone combat
Size	9.00 x 20
Plies	12
Inflation pressure	65 lb
Rolling radius, inflated	19.5 in.
Capacity per tire (80-lb inflation)	3,450 lb
Revolutions per mile	517
Loaded rolling radius, with zero inflation	17.8 in.
Tread design	Mud and snow

149. TIRE REPLACEMENT.

a. **Removal.** CAUTION: *The tire must be completely deflated before removing the cap screws on the clamp ring (fig. 42) to prevent injury from the clamp ring being forced off due to the large amount of pressure*

WHEELS AND TIRES

in the tire. Deflate the tire. Remove the 18 clamp ring cap screws (fig. 42) and remove the clamp ring. Pull the tire assembly, including the tube from the rim.

b. **Installation.** Install the inner tube in the tire casing with the valve stem of the tube opposite the red dot on the sidewall of the tire casing and install the tire by reversing the sequence of steps of the removal procedure. Inflate to recommended pressure.

150. WHEEL REPLACEMENT.

a. Jack up the end of the axle so that the wheel clears the ground. Remove the 6 wheel nuts (fig. 42) and remove the wheel. To reinstall the wheel, reverse the sequence of steps of the removal procedure.

151. FRONT WHEEL BEARINGS.

a. **Description.** The front wheel bearings are Timken tapered roller bearing.

b. Replacement.

(1) **REMOVAL.** Jack up the desired end of the front axle so that the wheel clears the ground. Remove the 8 nuts, lock washers and wedges from the front axle drive flange plate. Remove the cap screw and lock washer from the center of the axle drive flange plate. Tighten the 2 remaining cap screws on the drive flange plate to force it part way off the brake drum. Pry the drive flange plate the rest of the way off the brake drum and remove the gasket. Straighten the tab on the lock washer and remove the hub nut and lock washer. Remove the hub adjusting nut and remove the wheel and brake drum. Lift the outer wheel bearing from the brake drum. Remove the grease retainer and lift the inner wheel bearing from the brake drum.

(2) **INSTALLATION.** Pack wheel bearings with lubricant before installation. Install inner wheel bearing in the brake drum. Using a driver, install the grease retainer in the brake drum. Install the brake drum and the wheel on the spindle. Slide the outer wheel bearing into the brake drum. Install the adjusting nut and run it up tight; then back it off (counterclockwise) 45 degrees. This establishes the correct wheel bearing adjustment. Install the lock washer and the outer nut. Tighten the outer spindle nut and bend the tab on the lock washer down to lock the spindle nut. Turn the 2 cap screws on the drive flange plate counterclockwise until they are flush with the machined surface of the drive flange plate. Install the gasket, drive flange plate, wedges, lock washers and nuts. Install the lock washer and cap screw in the center of the drive flange plate.

LIGHT ARMORED CAR M8

152. REAR WHEEL BEARINGS.

a. **Description.** The rear wheel bearings are Timken tapered roller bearings.

b. **Removal.** Jack up the desired end of the axle. Remove the 8 equally spaced nuts, lock washers and wedges from the axle shaft (fig. 42). Tighten the 2 remaining cap screws on the axle shaft to force it part way off the brake drum. Pull the axle shaft the rest of the way out of the axle housing and remove the gasket. Straighten the tab on the lock washer and remove the wheel bearing nut and pull the wheel and brake drum from the axle housing. Lift the outer wheel bearing from the brake drum. Remove the grease retainer and lift the inner wheel bearing from the brake drum.

c. **Installation.** Pack the wheel bearings with lubricant before installation. Install inner wheel bearing in the brake drum. Using a suitable driver, install the grease retainer in the brake drum. Install the wheel and the brake drum on the axle housing. Slide the outer wheel bearing into place in the brake drum. Install the adjusting nut and run it up tight with a wrench; then back it off (counterclockwise) 45 degrees. This establishes the correct wheel bearing adjustment. Install the lock washer and the outer nut. Tighten the outer hub nut and bend the tab on the washer down to lock the nut. Turn the 2 cap screws on the axle shaft counterclockwise until they are flush with the machined surface of the axle shaft. Install the gasket, axle shaft, wedges, lock washers and nuts.

Section XXVII
BRAKES

	Paragraph
General description and data.....	153
Hand brake controls.....	154
Hand brake adjustment.....	155
Hand brake band.....	156
Hand brake drum.....	157
Service brake controls.....	158
Service brake adjustment.....	159
Hydrovac	160
Master cylinder.....	161
Slave (wheel) cylinders.....	162
Hydraulic lines.....	163
Bleeding hydraulic brake system.....	164
Brake drums.....	165
Brake shoes	166

153. GENERAL DESCRIPTION AND DATA.

a. Description.

- (1) **HAND BRAKE.** The hand brake is located on the forward side of the transfer case (fig. 44). The brake is of the external contracting type and is adjustable. The brake is actuated by a hand brake lever, mounted horizontally in front of the instrument panel (fig. 6).
- (2) **SERVICE BRAKES.** A hydraulically operated, 2 shoe internal expanding brake is provided at each of the 6 wheels. The pressure applied to the brake pedal is boosted by means of a Hydrovac booster. Each brake assembly has 2 slave cylinders, thus making each shoe a primary shoe.

b. Data.

(1) HAND BRAKE.

Location.....	Forward side of transfer case
Type.....	External contracting
Diameter	9½ in.
Width	3 in.
Lining thickness	0.25 in.
Lining length	24.62 in.
Total hand brake lining area.....	123.2 sq in.

LIGHT ARMORED CAR M8

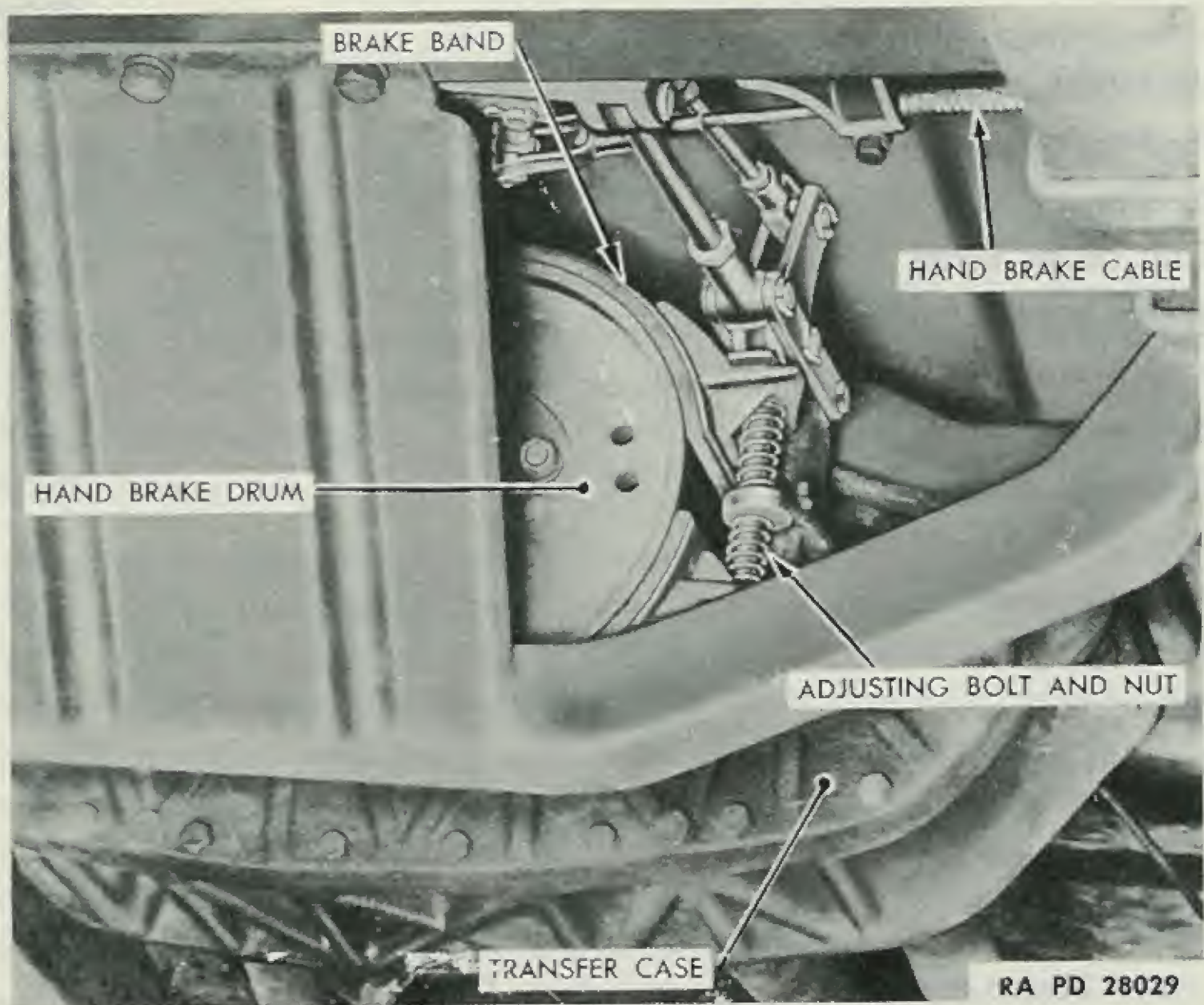


Figure 44 – Hand Brake Adjustments

(2) SERVICE BRAKE.

Diameter of wheel cylinders:

Front	1½ in.
Intermediate	1½ in.
Rear	1½ in.
Adjustment	Adjusting screw
Diameter of brakes	15 in.
Width of lining	2¼ in.
Thickness of lining	0.4 in.
Length of lining per shoe.....	15⅞ in.
Total brake area.....	429 sq in.

154. HAND BRAKE CONTROLS.

a. The hand brake controls consist of a hand brake lever (fig. 6) and a flexible steel cable and conduit.

BRAKES

155. HAND BRAKE ADJUSTMENT (fig. 44).

a. Set the hand brake lever in release position. Remove the lock wire from the head of the anchor bolt on the right-hand side of the brake band and turn down the bolt until an 0.020-inch feeler gage will just pass between the brake band and the drum. Tighten the self locking nut on the adjusting bolt (fig. 44) attached to the side of the brake band until an 0.020-inch feeler gage will just pass between the drum and brake band. Check the brake band and drum surface with an 0.020-inch feeler gage for clearance of the entire circumference. Install new locking wire.

156. HAND BRAKE BAND (fig. 44).

a. The brake band is located on the hand brake drum mounted on the forward side of the transfer case. This is a curved steel band (fig. 43) with brake lining riveted on the inner side.

157. HAND BRAKE DRUM (fig. 44).

a. The hand brake drum is mounted on the transfer case drive shaft. The drum is 9½ inches in diameter and is so designed as to supply adequate cooling area for dissipation of heat.

158. SERVICE BRAKE CONTROLS.

a. The service brakes are hydraulically controlled. The hydraulic controls include the master cylinder, hydraulic lines, Hydrovac power cylinder and the slave cylinders at each wheel.

159. SERVICE BRAKE ADJUSTMENT (fig. 45).

a. **Pedal Adjustment.** The free travel of the brake pedal should be adjusted by means of the clevis at the master cylinder so that the pedal has a free movement of ¼ inch measured at the pad, before contacting the master cylinder piston.

b. **Shoe Adjustment.** Adjustment of the service brake is made by means of adjusting 2 screws on each brake housing plate (fig. 45). When adjusting the brake, run the screws (fig. 45) in (clockwise) until the shoes contact the drum. Then back off 5 notches.

160. HYDROVAC (fig. 13).

a. **Description.** The Hydrovac is a power cylinder located on the left side of hull in the engine compartment. This power cylinder uses the vacuum of the engine to step up or amplify the pressure manually applied to the brakes. This reduces the manual effort required to apply the brakes.

LIGHT ARMORED CAR M8

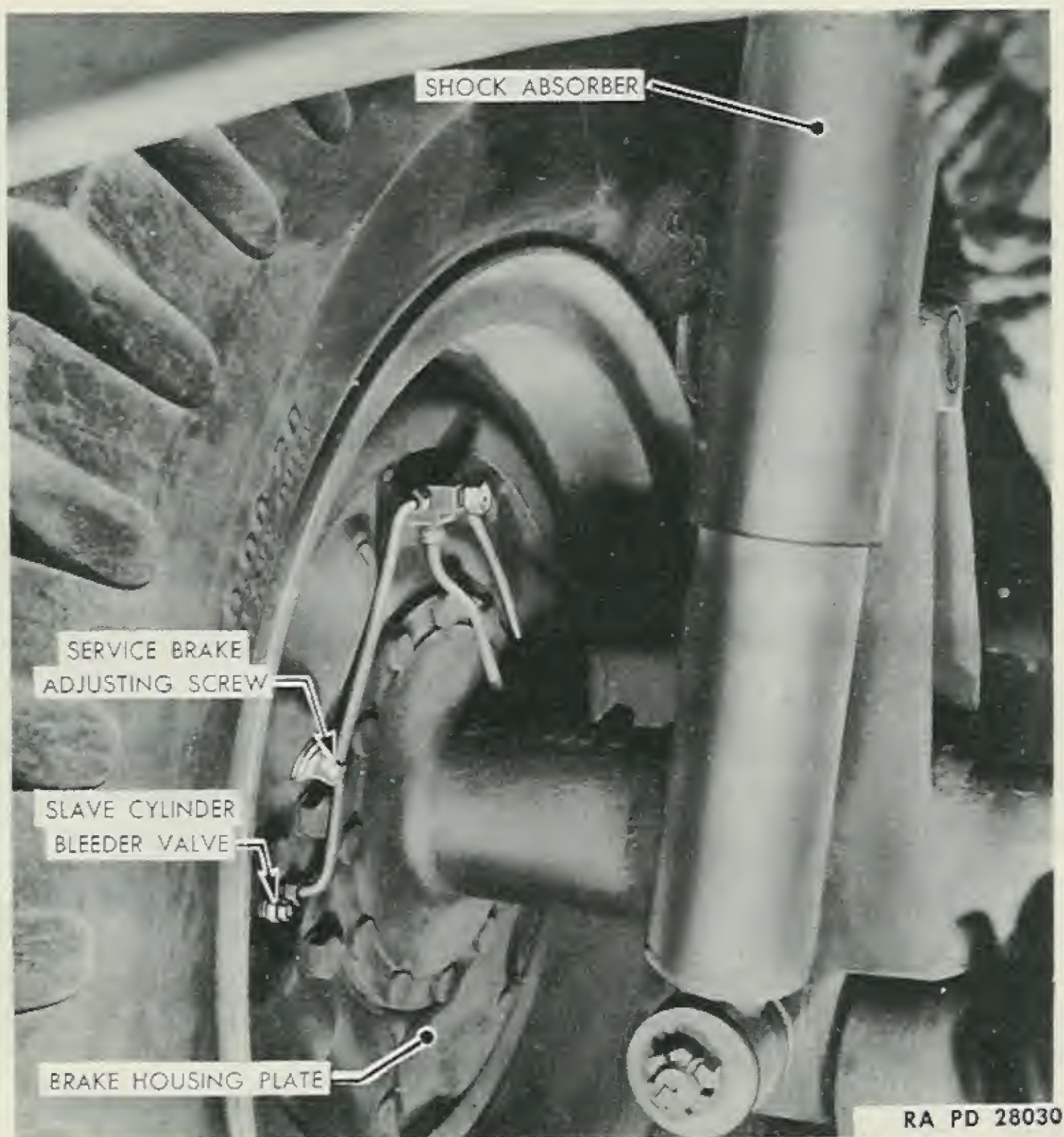


Figure 45 — Brake Adjusting Screw

b. Replacement of the Hydrovac.

(1) **REMOVAL.** Open the engine compartment doors. Disconnect the vacuum and air cleaner lines at the Hydrovac. Disconnect the 4 hydraulic lines from the Hydrovac slave cylinder. Remove the 4 nuts and spacer washers that secure the Hydrovac to the mounting bracket and remove the unit.

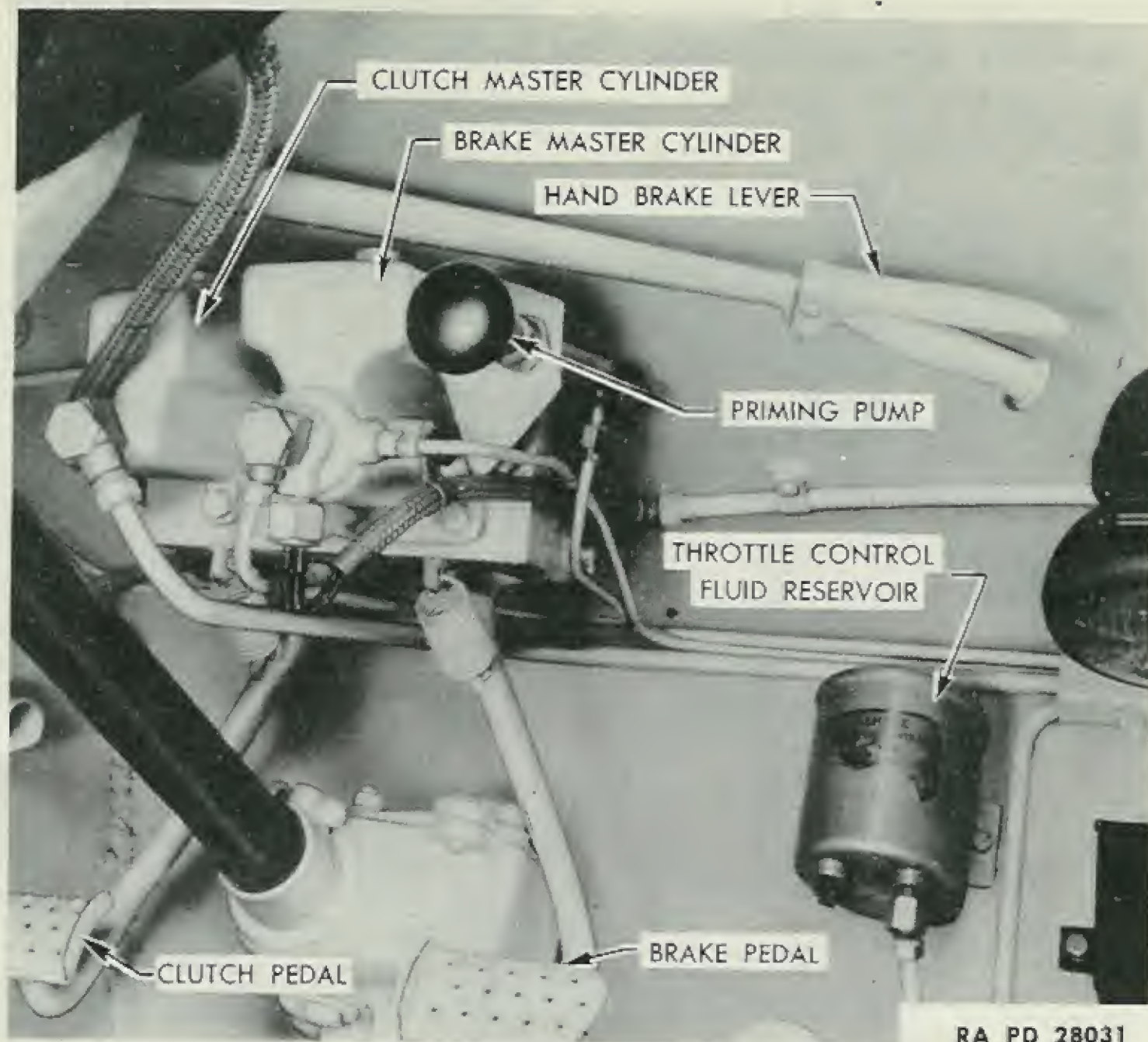
(2) **INSTALLATION.** Reverse sequence of the steps of the removal procedure and bleed the hydraulic system as outlined in paragraph 164.

161. MASTER CYLINDER (fig. 46).

a. Description. The master cylinder is located in the driver's compartment mounted on the front slope to the right of the steering column.

BRAKES

(fig. 46). The master cylinder is actuated by the service brake foot pedal and provides movement of the hydraulic fluid to the Hydrovac power cylinder (par. 160).



RA PD 28031

Figure 46 — Master Cylinders

b. Replacement of the Master Cylinder.

(1) **REMOVAL.** Disconnect the hydraulic lines attached to the master cylinder. Remove link pin which attaches the master cylinder to the brake pedal. Remove the mounting screws that secure the master cylinder to the mounting bracket and remove the master cylinder.

(2) **INSTALLATION.** Reverse sequence of the steps of the removal procedure. Refill master cylinder with hydraulic fluid and bleed the system as outlined in paragraph 164.

162. SLAVE (WHEEL) CYLINDERS.

a. **Description.** Two slave cylinders are used at each wheel brake and are mounted on the brake housing plate. The slave cylinders operate the brake shoes when hydraulic pressure is applied.

LIGHT ARMORED CAR M8

b. Replacement of the Slave Cylinders.

(1) REMOVAL. Remove the wheel by removing the 6 wheel nuts. Remove the brake drum as outlined in paragraph 165. Remove brake shoe hold-down bolts and remove the brake shoes. Unhook the brake shoe retracting springs. Disconnect the hydraulic line from the slave cylinder (fig. 45). Remove the 4 cap screws that hold the slave cylinder to the brake housing plate and remove the slave cylinder.



RA PD 28032

Figure 47 — Bleeder Tube and Jar for Bleeding Hydraulic Brake System

(2) INSTALLATION. Reverse sequence of steps of the removal procedure, except that when installing the brake shoe hold-down bolts, draw up the nuts tight and then back off one turn and install cotter pin. Bleed hydraulic system as outlined in paragraph 164.

163. HYDRAULIC LINES.

a. The hydraulic brake lines consist of sections connected together with threaded connectors. This allows any section to be replaced separately. It will be necessary to bleed the system when any of the lines are replaced (par. 164).

BRAKES

164. BLEEDING HYDRAULIC BRAKE SYSTEM.

a. **Bleeding the Hydrovac.** The Hydrovac unit must be bled at the 3 bleeder valves in the following order, 1, 2, and finally 3. The No. 1 valve is the farthest to the rear on the unit. Follow the same procedure for bleeding as outlined below for the slave cylinders.

b. **Bleeding the Slave Cylinders.** Remove the filler plug from the master cylinder reservoir (fig. 46) and fill with hydraulic fluid. Remove the slave cylinder bleeder valve dust cap (fig. 45) and attach a bleeder tube to the slave cylinder bleeder valve. Place the end of the bleeder tube in a clear glass jar containing some hydraulic fluid (fig. 47). Open the bleeder valve about $\frac{3}{4}$ of a turn. Pump the brake pedal slowly, some fluid or air will come out with each stroke. **NOTE:** *Keep the master cylinder filled with brake fluid while pumping the brake pedal.* Continue to pump the pedal until no more bubbles come out of the bleeder tube. When, with each stroke, only fluid comes out of the bleeder tube, close the bleeder valve. Refill the master cylinder (fig. 46) and repeat the above operation on the 11 other slave cylinders.

165. BRAKE DRUMS.

a. To remove the brake drums, remove the 6 wheel nuts and lift off the wheel. Remove 3 flat-head screws securing the drum to the hub. Install 3 cap screws, $\frac{1}{2}$ x 13, in the holes provided and screw in until drum is loosened. Remove the drum. The drums are installed by reversing the above procedure.

166. BRAKE SHOES.

a. **Description.** Each wheel brake is provided with 2 internal expanding brake shoes. The shoes are lined with molded type brake lining.

b. **Replacement of the Brake Shoes.** Remove the wheel and drum as outlined in paragraph 165. Remove brake shoe hold-down bolts and remove shoes. Unhook brake shoe retracting springs. To reinstall the brake shoes, reverse sequence of the steps of the removal procedure, except that when installing the brake shoe hold-down bolts draw up the nuts tight and then back off one turn and install a cotter pin.

LIGHT ARMORED CAR M8

Section XXVIII

HULL AND TURRET

	Paragraph
General description	167
Inspection after combat	168
Vision devices	169
Hatch covers and engine compartment doors	170
Driver's compartment seats	171
Turret seats	172
Turret	173
Fenders and external boxes	174
Pintle	175

167. GENERAL DESCRIPTION.

a. The all-welded hull is of armor plate. At the front, the armor plate is $\frac{3}{4}$ inch and $\frac{5}{8}$ inch thick. The sides are $\frac{3}{8}$ inch thick. The driver's and the assistant driver's hatch covers are $\frac{1}{4}$ -inch armor plate (fig. 49).

168. INSPECTION AFTER COMBAT.

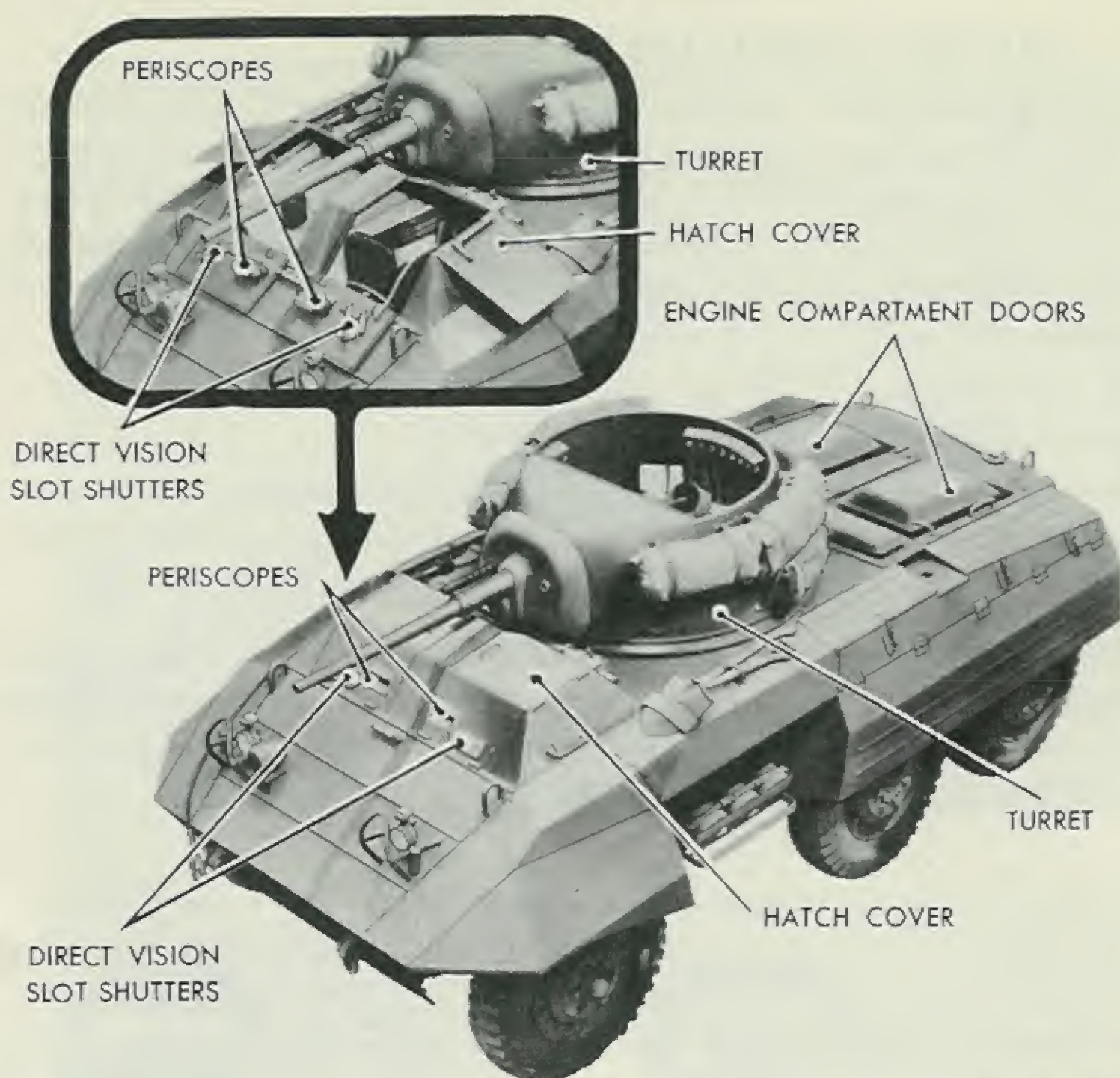
a. **General.** Ordinarily, the hull and turret will require little attention other than careful checking to see that all parts are tight and that hinges and other moving parts are properly lubricated. After the vehicle has been in combat, however, special inspections must be made.

b. **Inspection.** Check hull and turret, inside and out, for evidences of cracks or damage from fire. Remove debris or bullet splash from turret race, and from behind gun shields. Check complete 360-degree traverse of turret to determine any obstruction or restricted movement. Inspect all periscope mounts for presence and condition of covers and free action. Elevate and depress the 37-mm gun to its full extent of travel, to determine any restriction of movement. Inspect direct vision slots and shutters.

169. VISION DEVICES (fig. 49).

a. Direct vision slots are provided in the front of and to the side of the hatch covers in the driver's and assistant driver's compartment (figs. 48 and 49). Shutters are provided for each slot with control handles on the inside. Two periscope slots fitted with periscopes are also provided, one in each hatch front cover, for use when the direct vision slots are covered with the shutters.

HULL AND TURRET



RA PD 28033

Figure 48 — Left Front View from Above

170. HATCH COVERS AND ENGINE COMPARTMENT DOORS.

a. **Hatch Covers.** The hatch covers over the driver and assistant driver can be tipped forward to gain access to these compartments. When not in combat, these hatch covers may be left down as shown in the insert in figure 48 to increase the field of vision.

b. **Engine Compartment Doors** (fig. 48). The engine compartment is provided with 2 hinged doors (fig. 48). To remove the doors, remove the pins from each of the 4 hinges. Raise doors and place supports in position to hold doors up. Remove the ground strap from each door and remove the doors. To remove the hinge plate, remove the screws holding the filter box to the hinge plate and remove the filter. Remove the 2 cap screws from each end of the hinge plate and remove the hinge plate. These parts are reinstalled by reversing the sequence of steps in the removal procedure.

LIGHT ARMORED CAR M8

171. DRIVER'S COMPARTMENT SEATS.

a. The driver's and assistant driver's seats consist of cushions held to the floor with snap on buttons, also cushions on the seat backs held on with snap on buttons. To remove the seat back, disconnect the snap fasteners and remove the cushion. Remove the 4 cap screws and remove seat back frame. To reinstall, reverse the sequence of steps in the removal procedure.

172. TURRET SEATS (fig. 4).

a. **Description.** Two round padded seats are provided, one for the gunner and one for the loader. These seats are adjustable, a lever under the seats controls the raising or lowering on the seat bracket.

b. **Replacement.** To remove either seat, remove the 4 nuts at the top and the 6 bolts at the bottom of the seat bracket. Remove the bracket and remove seat from bracket. Reinstall the seats by reversing the sequence of above steps.

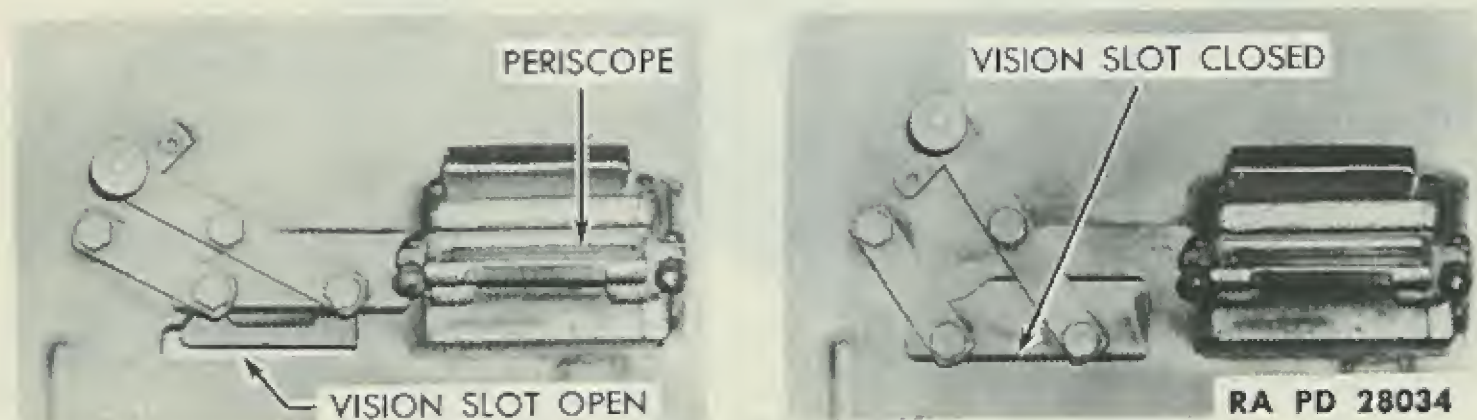


Figure 49 — Direct Vision Slots and Periscopes

173. TURRET.

a. **Description.** The turret is of cast steel 0.7 inch thick. The turret can be traversed through 360 degrees by a hand-operated gear mechanism. The turret may be locked in position by means of the turret lock which is attached to the turret traversing mechanism. The turret is supported by 3 turret support rollers (fig. 9) spaced 120 degrees apart which project through a circular ring gear track fastened to the hull. Lateral and vertical motion of the turret is prevented by means of hold-down rollers which contact the side and upper surface of the turret bearing surface. There are 12 of these rollers used, 2 in each of the 6 brackets which are spaced equally around the circumference of the turret track. A removable folding canopy of heavy canvas is provided for the protection of the crew and the vehicle interior. It is attached to the turret by snap fasteners.

HULL AND TURRET

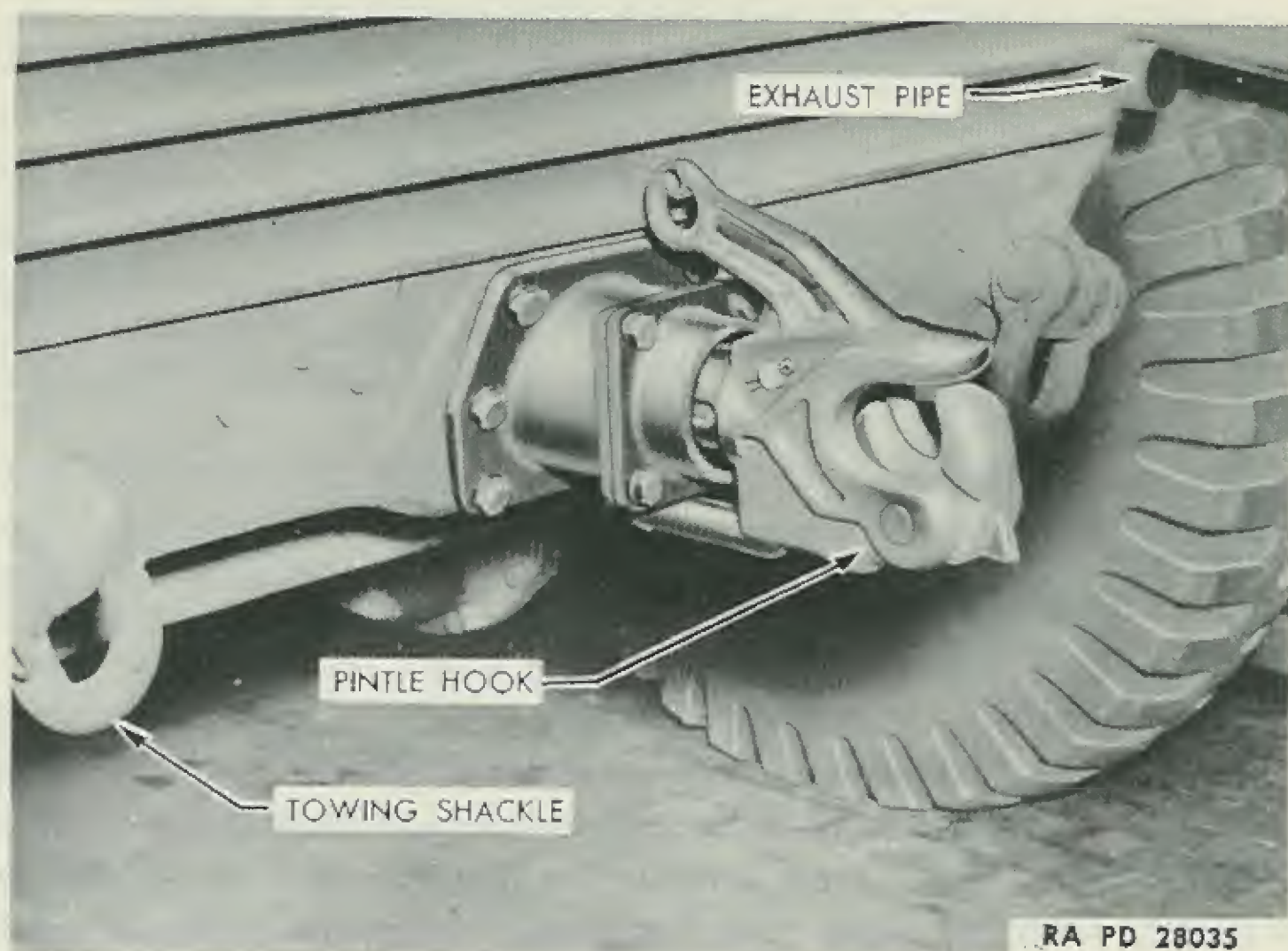


Figure 50 — Pintle Hook

b. Removal of Turret. To remove turret, remove the small bolts which hold the index number plates to the turret and remove the plates. Remove the 4 bolts from each of the 6 brackets which hold the hold-down rollers and remove the bracket assemblies. Lift off the turret with hoist after attaching a suitable rope or cable to the turret.

c. Installation of Turret. To install turret, remove sequence of the steps in removal procedure, making certain that all bearing surfaces are clear and that turret turns freely.

174. FENDERS AND EXTERNAL BOXES.

a. External boxes of sheet metal are provided for storage of supplies. These boxes are integral with the rear fenders (fig. 1). The front and rear fenders and the boxes are bolted to the hull. To remove them, remove all attaching bolts from the fenders and boxes and flat-head screws from the hinges and remove.

175. PINTLE (fig. 50).

a. A pintle hook of the quick release type operated by a cable from inside the vehicle is provided on the rear of the vehicle for towing a trailer only (fig. 50). The pintle is attached to the hull by means of 6 bolts which are easily removed.

LIGHT ARMORED CAR M8

Section XXIX

PAINTING

	Paragraph
Painting	176
Preparing for painting	177
Painting metal surfaces	178
Paint as a camouflage	179
Removing paint	180
Painting lubricating devices	181

176. PAINTING.

a. **General.** Ordnance materiel is painted before issue to the using arms and one maintenance coat per year will ordinarily be ample for protection. With but few exceptions this materiel will be painted with ENAMEL, synthetic, olive-drab, lusterless. The enamel may be applied over old coats of long oil enamel and oil paint previously issued by the Ordnance Department if the old coat is in satisfactory condition for repainting.

b. **Reduction.** Paints and enamels are usually issued ready for use and are applied by brush or spray. They may be brushed on satisfactorily when used unthinned in the original package consistency or when thinned not more than 5 percent by volume with THINNER. The enamel will spray satisfactorily when thinned with 15 percent by volume of THINNER. (Linseed oil must not be used as a thinner since it will impart a luster not desired in this enamel.) If sprayed, it dries hard enough for repainting within 1/2 hour and dries hard in 16 hours.

c. **Exceptions.** Certain exceptions to the regulations concerning painting exist. Fire-control instruments, sighting equipment and other items which require a crystalline finish will not be painted with olive-drab enamel.

d. **References.** Complete information on painting is contained in TM 9-850.

177. PREPARING FOR PAINTING.

a. **General.** If the base coat on the materiel is in poor condition, it is more desirable to strip the old paint from the surface than to use sanding and touchup methods. After stripping, it will then be necessary to apply a primer coat.

PAINTING

b. **Primer for Wood.** PRIMER, ground, synthetic, should be used on wood as a base coat for synthetic enamel. It may be applied either by brushing or spraying. It will brush satisfactorily as received or after the addition of not more than 5 percent by volume of THINNER. It will be dry enough to touch in 30 minutes and hard in 5 to 7 hours. For spraying, it may be thinned with not more than 15 percent by volume of THINNER. Lacquers must not be applied to the PRIMER, ground, synthetic, within less than 48 hours.

c. **Primer for Metal.** PRIMER, synthetic, rust-inhibiting, for bare metal, should be used on metal as a base coat. Its use and application are similar to those outlined in subparagraph b, above.

d. **Preparation.** The success of a job of painting depends partly on the selection of a suitable paint, but also largely upon the care used in preparing the surface prior to painting. All parts to be painted should be free from rust, dirt, grease, kerosene, oil, and alkali, and must be dry.

178. PAINTING METAL SURFACES.

a. If metal parts are in need of cleaning, they should be washed in a liquid solution consisting of $\frac{1}{2}$ pound of SODA ASH in 8 quarts of warm water, or an equivalent solution, then rinsed in clear water and wiped thoroughly dry. Wood parts in need of cleaning should be treated in the same manner, but the alkaline solution must not be left on for more than a few minutes and the surfaces should be wiped dry as soon as they are washed clean. When artillery or automotive equipment is in fair condition and marred only in spots, the bad places should be touched with ENAMEL, synthetic, olive-drab, lusterless, and permitted to dry. The whole surface will then be sandpapered with PAPER, flint, No. 1, and a finish coat of ENAMEL, synthetic, olive-drab, lusterless, applied and allowed to dry thoroughly before the materiel is used. If the equipment is in bad condition, all parts should be thoroughly sanded with PAPER, flint, No. 2, or equivalent, given a coat of PRIMER, ground, synthetic, and permitted to dry for at least 16 hours. They will then be sandpapered with PAPER, flint, No. 00, wiped free from dust and dirt, and a final coat of ENAMEL, synthetic, olive-drab, lusterless, applied and allowed to dry thoroughly before the materiel is used.

179. PAINT AS A CAMOUFLAGE.

NOTE: Camouflage is now a major consideration in painting ordnance vehicles, with rust prevention secondary. The camouflage plan at present employed utilizes three factors: color, gloss and stenciling.

LIGHT ARMORED CAR M8

a. **Color.** Vehicles are painted with ENAMEL, synthetic, olive-drab, lusterless, which was chosen to blend in reasonably well with the average landscape.

b. **Gloss.** The new lusterless enamel makes a vehicle difficult to see from the air or from relatively great distances over land. A vehicle painted with ordinary glossy paint can be detected more easily and at greater distances.

c. **Stenciling.** White stencil numbers on vehicles have been eliminated because they can be photographed from the air. A blue-drab stencil enamel is now used which cannot be so photographed. It is illegible to the eye at distances exceeding 75 feet.

d. Preserving Camouflage.

(1) **CLEANING.** Continued friction or rubbing must be avoided, as it will smooth the surface and produce a gloss. The vehicle should not be washed more than once a week. Care should be taken to see that the washing is done entirely with a sponge or a soft rag. The surface should never be rubbed or wiped, except while wet, or a gloss will develop.

(2) **DUST AIDS CAMOUFLAGE.** It is not desirable that vehicles, painted with lusterless enamel, be kept as clean as vehicles were kept when glossy paint was used. A small amount of dust increases the camouflage value. Grease spots should be removed with SOLVENT, dry-cleaning. Whatever portion of the spot cannot be so removed should be allowed to remain.

(3) **GLOSS CAUSED BY TARPAULINS.** Continued friction of wax-treated tarpaulins on the sides of a vehicle will also produce a gloss, which should be removed with SOLVENT, dry-cleaning.

(4) **WHEN TO REPAINT.** Tests indicate that repainting with olive-drab paint will be necessary once yearly, with blue-drab paint twice yearly.

180. REMOVING PAINT.

a. After repeated paintings, the paint may become so thick as to crack and scale off in places, presenting an unsightly appearance. If such is the case, remove the old paint by use of lime-and-lye solution (see TM 9-850 for details) or REMOVER, paint and varnish. It is important that every trace of lye or other paint remover be completely rinsed off and that the equipment be perfectly dry before repainting is attempted. It is preferable that the use of lye solutions be limited to iron or steel

PAINTING

parts. If used on wood, the lye solution must not be allowed to remain on the surface for more than a minute before being thoroughly rinsed off and the surface wiped dry with rags. Crevices or cracks in wood should be filled with putty and the wood sandpapered before refinishing. The surfaces thus prepared should be painted according to directions in paragraph 32.

181. PAINTING LUBRICATING DEVICES.

a. Oil cups, grease fittings, oilholes, and similar lubricating devices, as well as a circle about $\frac{3}{4}$ inch in diameter at each point of lubrication, will be painted with ENAMEL, synthetic, gloss-red, in order that they may be readily located.

LIGHT ARMORED CAR M8

Section XXX

REFERENCES

	Paragraph
Standard nomenclature lists	182
Explanatory publications	183

182. STANDARD NOMENCLATURE LISTS.

a. Ammunition.

Ammunition, blank, for pack, light and medium field artillery	SNL R-5
Ammunition, fixed and semifixed, all types, for pack, light, and medium field artillery, including complete round data	SNL R-1
Ammunition instruction material for pack, light and medium field artillery	SNL R-6
Ammunition, rifle, carbine, and automatic gun.....	SNL T-1
Firing tables and trajectory charts (index)	SNL F-69
Ground mines and fuzes, demolition material for use in policing target ranges, and ammunition for simulated artillery and grenade fire	SNL R-7

b. Armament.

Carbine, cal. .30, M1 and M1A1	SNL B-28
Gun, machine, cal. .30, Browning, M1919A4 — fixed and flexible, and M1919A5 — fixed, and ground mounts	SNL A-6
Gun, 37-mm, M5 and M6, and cradle, tank, 37-mm, T2	SNL A-45
Mount, small-arms, for motor vehicles	SNL A-55 Vol. VI

c. Car, armored, light, M8 (Ford)	SNL G-136
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d. Maintenance.

Cleaning, preserving and lubricating materials, recoil fluids, special oils, and miscellaneous related items	SNL K-1
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REFERENCES

Soldering, brazing and welding material, gases and related items	SNL K-2
Tools, maintenance, for repair of automatic guns, automatic gun antiaircraft materiel, automatic and semiautomatic cannon, and mortars	SNL A-35
Truck, small-arms repair, M1	SNL G-72
Current Standard Nomenclature Lists are as tabulated here. An up-to-date list of SNL's is maintained as the "Ordnance Publications for Supply Index"	OPSI

183. EXPLANATORY PUBLICATIONS.

a. Ammunition.

Grenades	FM 23-30
Grenades	OFSB 3-10
Irritant candles, tear pots, smoke pots, and chemical land mines	TM 3-300
Land mines	TM 9-1940
Ordnance maintenance: Ammunition, general	TM 9-1900
Ordnance maintenance: Small-arms ammunition	TM 9-1990
Qualifications in arms and ammunition training allowances	AR 775-10
Small-arms ammunition	OFSB 3-5
Target, target materials, and rifle range instruction	TM 9-855

b. Armament.

Browning machine gun, cal. .30, HB, M1919A4 (mounted in combat vehicles)	FM 23-50
Ordnance maintenance: Browning machine gun, cal. .30, all types, U. S. machine gun, cal. .22, and trainer, cal. .22	TM 9-1205
Ordnance maintenance: 37-mm gun materiel (tank) M5 and M6	TM 9-1250
U. S. carbine, cal. .30, M1	FM 23-7
37-mm gun, tank, M6 (mounted in tanks)	FM 23-81

LIGHT ARMORED CAR M8

c. Communications.

Radio fundamentals	TM 11-455
Radio set SCR 506	TM 11-630
Radio set SCR 510	TM 11-605
Radio set SCR 608	TM 11-620
Radio set SCR 610	TM 11-615
Radio sets SCR 508, SCR 528, and SCR 538	TM 11-600
The radio operator	TM 11-454

d. Maintenance.

Automotive brakes	TM 10-565
Automotive electricity	TM 10-580
Automotive lubrication	TM 10-540
Automotive power transmission units	TM 10-585
Chassis, body and trailer units	TM 10-560
Cleaning, preserving, lubricating, and welding materials and similar items issued by the Ordnance Department	TM 9-850
Defense against chemical attack	FM 21-40
Detailed lubrication instructions for ordnance materiel	OFSB 6-Series
Echelon system of maintenance	TM 10-525
Fire prevention, safety precautions, accidents	TM 10-360
Motor transport inspections	TM 10-545
Sheet metal work, body, fender and radiator repairs	TM 10-450
The motor vehicle	TM 10-510
Tune-up and adjustment	TM 10-530

e. Miscellaneous.

Camouflage	FM 5-20
Electric fundamentals	TM 1-455
Fuels and carburetion	TM 10-550
List of publications for training	FM 21-6

REFERENCES

Military motor transportation	TM 10-505
Military motor vehicles	AR 850-15
Motor transport	FM 25-10
The internal combustion engine	TM 10-570

f. Storage and Shipment.

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Storage of military motor vehicles	AR 850-18
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LIGHT ARMORED CAR M8

INDEX

A	Page No.		Page No.
Accessories		front	
armament	41-42	description	134
carried on vehicle	36-37	maintenance	48-49
engine, references for	59	replacement	135
general discussion of	57	shaft replacement	134
Adjustments:		tie rod	135
automatic choke	87	rear and intermediate.....	137
breaker points	78	maintenance	49
clutch	120-121	wheel alinement	
fan belts	93-94	specifications	131
generator belt	102	trouble shooting	131-134
generator regulator	103		
hand brake	149	B	
service brake	149	Backfiring	63-64
shock absorbers	141	Backing the vehicle.....	21-22
idling speed	82-83	Battery	103
throttle control	84	cables	104
toe-in of front wheels.....	135	Battery master switch	
turret compass	117	description and removal.....	113
drift	118	location and use.....	17
Air cleaners	84	Bearings, wheel	
Alinement, wheel (See Wheel		front	145
alinement)		rear	146
Altitudes, high, operation at.....	23-24	Blackout driving light switch	
Ammeter		description and replacement.....	112
description and replacement.....	112	location and use.....	14
location and use.....	12	Blackout head lamp.....	107
Ammunition		Blackout marker bulb	105
cleaning exposed to gas.....	45	Bleeding	
stowage	27	hydraulic brake system.....	153
Antifreeze	90	hydraulic lines	123
Armament		throttle control system.....	86-87
ammunition stowage	27	Bogie	
combination gun mount.....	25	bracket	141
data	9	description	139
gunner's controls, illustration.....	26	shaft bearing replacement.....	139-140
unmounted guns	25	torque rods	140-141
Armature brush current to battery		Bore	58
circuit	99	Boxes, external	157
Armor	3, 9, 154	Brakes	
Assignment record	34	brake drums	153
Automatic choke	87	brake shoes	153
Automotive materiel, special precau-		description and data.....	147-148
tions for	46	hand brake adjustment.....	149
Axles		hand brake band and drum.....	149
clearance under, data on.....	10	hand brake controls.....	148
description and data.....	131	hydraulic brake system, bleeding....	153

INDEX

B—Cont'd

Page No.

Page No.

Brakes—Cont'd	
hydraulic lines	152
hydrovac	149–150
maintenance	
hand-parking	50
service (foot)	49
master cylinder	150–151
service brake adjustment and controls	149
slave (wheel) cylinders.....	151–152

C

Camshaft	69
Capacity of cooling system.....	90
Carburetor	
description	82
idle adjustment	82–83
make and model.....	59
removal and installation.....	83
Carburetor bowl, no fuel in.....	62
Care and preservation	
cleaning	34–35
records	34
tools and accessories.....	42, 56
Casualties, lung irritant and vesicant	44
Chemicals, materiel affected by	
decontamination	43–45
general discussion of.....	43
protective measures	43
special precautions for automotive materiel	46
Circuit breakers	
description and replacement.....	110
location and use.....	12
Cleaning:	
ammunition exposed to gas.....	45
spark plugs	80
vehicle	34, 160
Clearance under axles, data on.....	5
Clutch	
adjustment	120–121
controls	120
description and data.....	119
disk and pressure plate.....	121
hydraulic lines	123
maintenance	50, 120
master cylinder	121–122
slave cylinder	122
Clutch pedal, location and use.....	17

Cold weather, starting engine in....	20, 23
Color used to paint vehicle.....	160
Communication, data on.....	9
Compensation (turret compass)	116–118
Compression ratio	58
Conduit and cables	
maintenance	113–114
purpose	113
replacement	114
Controls	
battery master switch.....	17
clutch	120
clutch pedal	17
foot throttle	15
front axle engaging lever.....	17
gearshift lever	17
hand brake lever	15
primer	17
service brake foot pedal	15
spark control	15
steering wheel	15
transfer case gear ratio selecting lever	17

Cooling system	
antifreeze	90
description and data	90
fan belts	93–94
fans	93
hose	95
maintenance	50
radiator	90–91
thermostat	94–95
water pump	92–93
Corrosion, control of in cooling system	90
Cracks in castings for metal parts, detection of	28
Crankcase breather	74
Crew, data	10
Current limiter	102
Cylinder head	73
Cylinders, test for missing	29

D

Data	
armament	9
armor thickness	9
brakes	
hand	147
service	148

LIGHT ARMORED CAR M8

D—Cont'd	Page No.		Page No.
Data—Cont'd		combination gun mount and un-	
clutch	119	mounted guns	25
communication	9	cooling system	90
engine	5, 58-59	fans and fan belts	93
fuel and oil	9	radiator	90-91
general	5	rubber hose	95
ignition system	75	thermostat	94-95
limitations of vehicle	10	water pump	92
performance of engine and		electrical system	96
vehicle	10	ammeter	12, 112
protective padding	9	battery	103
protective vision	9	cables	104
seats	9	battery master switch	113
tires	10, 144	blackout driving light switch	14
transfer case	129	circuit breakers	110
transmission	127	fire detector signal system	109
wheel alinement	131	fuel level gage	113
wheels	144	generating system	99
Decontamination		generator	101
instruments	45	generator regulator	102-103
metal parts, unpainted	45	instrument panel light	
protection of personnel	43-44	rheostat	112
Definitions of:		instrument panel lights	112
echelons and maintenance		lamps	105
terms	47-48	blackout head	107
"left," "right," and "front"	59	service head	105
"left" and "right"	11	tail	107
Depression of 37-mm gun	25	light switch	11
Description		oil pressure gage	109
axles	131	siren	110
front	134	push button	111
rear	137	starter switch button	110
bearings, wheel		starting motor	104
front	145	starting solenoid	104-105
rear	146	starting system	104
bogie	139	voltmeter	108
bracket	141	water temperature gage	108
torque rods	140	wiring	115
brakes	147	engine	58
brake shoes	153	crankcase breather	74
hydrovac	149	cylinder head	73
master cylinder	150-151	exhaust system	74
slave (wheel) cylinders	151	lubrication system	66-67
clutch	119	manifolds	70
disk and pressure plate	121	oil filter	73
hydraulic lines	123	oil pan	71
master cylinder	121	oil pump	72
slave cylinder	122	valve mechanisms	69

INDEX

D—Cont'd	Page No.		Page No.
Description—Cont'd		after 500 miles of operation	30
fuel system	81–82	after operation	30
air cleaners	84	at halt	29
automatic choke	87	Driver's compartment seats	156
carburetor	82	Dust	
fuel filter	88	aid in camouflage	160
fuel pump	87	operation in	24
priming pump and fuel lines	89	E	
throttle control	84	Echelons defined	47
hull and turret	154	Electrical system	
ignition system	75	ammeter	112
distributor	77	battery	103
ignition coil	76	cables	104
ignition switch	75	battery master switch	113
spark plugs and high tension		blackout driving switch	112
wires	80	circuit breakers	110
pitman arm	142	conduit and cables	113–114
propeller shafts and universal		description, general	96
joints	124	fire detector signal system	109
pillow block	126	fuel level gage	113
shock absorbers	141	generating system	99–101
speedometer	116	generator	101–102
spring shackles	139	generator regulator	102–103
springs, front and rear	138	instrument panel	107–108
steering gear	142	instrument panel light	
tires	144	rheostat	112
transfer case	129	instrument panel lights	112
transmission	127	lamps	105–107
turret	156	light switch	111
turret compass	116	maintenance	50–51
vehicle	3	oil pressure gage	109
wheels	144	siren	110
Diameter of wheel cylinders	149	push button	111
Dimensions, over-all, data on.....	5	starter switch button	110
Direction of rotation	59	starting motor	104
Distributor		starting solenoid	104–105
breaker points	78	starting system	104
description	77	trouble shooting	114–115
replacement	77–78	voltmeter	108–109
setting in place	79	water temperature gage	108
Drag link		wiring	115
description	142–143	Elevation of 37-mm gun	25
replacement	143	Engine	
Draining:		accessories	59
cooling system	90	crankcase breather	74
fuel filter	88	cylinder head	73
Drift adjustment, compass	118	data	5, 58–59
Driver's compartment, inspection in..	19	definition of terms	59

LIGHT ARMORED CAR M8

E—Cont'd	Page No.		Page No.
Engine—Cont'd		Exhaust system	
description	58	general discussion of	74
exhaust system	74	maintenance	53
inspection after 5,000 miles of		External boxes	157
operation	31		
inspection after installation of ..	31-32		
location and mountings	59		
location and type	3		
lubrication system	66-67		
maintenance	51-53		
manifolds	70		
motor mounts	70		
oil filter	73-74		
oil pan	71		
oil pump	72-73		
replacement	67-68		
starting	19		
warm and cold weather	20		
stopping	22		
test	21		
trouble shooting	61-66		
valve mechanism	69-70		
Engine accessories	59		
Engine compartment, inspection in	18		
after 500 miles of operation	30-31		
Engine compartment doors	155		
Engine idling speed, minimum	10		
Engine temperature gage, location			
and use	14		
Equipment and special tools	56		
Equipment and tools on vehicle			
care of	42		
equipment and location			
accessories and equipment	36-37		
accessories (armament)	41-42		
rations	40		
signaling equipment	40		
sighting equipment	40-41		
tools			
cal. .30 machine gun	39		
pioneer	37		
vehicular	37-39		
Exterior of vehicle, inspection of			
after 500 miles of operation	31		
after operation	30		
at halt	29		
Exhaust, black smoke emitted from..	63		

INDEX

F—Cont'd	Page No.		Page No.
Fuel lines, description	89	Hand pulls, operation on	22
Fuel pump		Hatch covers	155
description and maintenance	87	High altitudes, operation at	23-24
repairs	87	High temperatures, operation at	23
replacement	87-88	High tension wires	80
Fuel system		Horsepower	58
air cleaners	84	Hose	95
automatic choke	87	Hull and turret	
carburetor	82-83	data	9
description and data	81-82	description	154
fuel filter	88	driver's compartment seats	156
fuel pump	87-88	fenders and external boxes	157
fuel tank	88	hatch covers and engine compart-	
maintenance and inspection	53, 82	ment doors	155
priming pump and fuel lines	89	inspection after combat	154
throttle control (See Throttle con-		maintenance	53-54
trol)		pintle	157
		turret	
		description	156
		removal and installation	157
		seats	156
		vision devices	154
		Hydraulic (brake) lines	123
		replacement	86, 152
		Hydraulic fluid reservoir	85-86
		Hydrometer, use of	103
		Hydrovac	
		bleeding	153
		description	149
		replacement	150
		I	
		Idling speed	
		adjustment	82-83
		oil pressure at	66
		Ignition, trouble shooting	63
		Ignition coil	
		description	76
		replacement	76-77
		Ignition switch	
		description	75
		location and use	14
		replacement	76
		Ignition system	
		description and data	75
		distributor	77-78
		high tension wires	80
		ignition coil	76-77
Gages			
maintenance	54		
use of on instrument panel	22		
Gearshift lever			
location and use	17		
operation	127		
Generating system			
armature brush to battery circuit	99		
description	99		
ground circuit	99		
trouble shooting	99-101		
Generator			
belt adjustment or replacement	103		
description	101		
maintenance	101-102		
Generator regulator			
adjustments and replacement	103		
description	102-103		
Gloss on vehicle	160		
Ground circuit	99		
Ground pressure, data on	5		
H			
Hand brake			
adjustment	149		
band and drum	149		
data on	147		
description	147		
Hand brake controls	148		
Hand brake lever, location	15		

LIGHT ARMORED CAR M8

I—Cont'd

Page No.

Ignition system—Cont'd

ignition switch	75-76
ignition timing	78-79
spark plugs	80
trouble shooting	63

Ignition timing	78-79
trouble	63

Inflation pressure of tires	10
-----------------------------------	----

Inhibitor, oil, use of	90
------------------------------	----

Inspections

after operation	29-30
at halt	29
battery	103
during operation	28-29
fuel system	82
hull and turret after combat	154
periodic inspection	
after 500 miles of operation....	30-31
after 5,000 miles of operation ..	31-32
prestarting	18-19
purpose of	28

Instrument panel

ammeter	12
blackout driving light switch	14
circuit breakers	12
description	107-108
engine temperature gage	14
fire detector signal	15
fire detector test button	15
fuel level gage	14
ignition switch	14
light switch	11
lights	12
oil pressure gage	14-15
replacement	108
rheostat switch	14
siren push button	14
speedometer	14
starter switch	14
use of gages on	22
voltmeter	12

Instruments

maintenance	54
nonelectrical (See Nonelectrical instruments)	

L

Page No.

Lamps

blackout head	107
description, general	105
service head	105
tail	107
"Left" defined	11, 59
Lewisite	43

Light switch

description and replacement	111
location and use	11

Lights

location and use	12
replacement	112

Limitations of vehicle, data	10
------------------------------------	----

Liquid vesicants	43
------------------------	----

Load distribution, data on	5
----------------------------------	---

"Log Book," use of	34
--------------------------	----

Low oil pressure	65
------------------------	----

Low tension circuit trouble shooting	114-115
--	---------

Lubricating devices, painting	161
-------------------------------------	-----

Lubrication	33
-------------------	----

Lubrication system	66-67
--------------------------	-------

Lung irritant casualties	44
--------------------------------	----

M

Maintenance

battery	103
clutch	120
conduit and cables	113-114
crankcase breather	74
duties of using arm personnel	
axle	
front	48-49
rear	49
brakes	
hand-parking	50
service (foot)	49
clutch	50
cooling system	50
electrical system	50-51
engine	51-53
exhaust system	53
fire extinguishing system	53
frame	53
fuel system	53
hull	53-54
instruments and gages	54
miscellaneous	54

INDEX

M—Cont'd	Page No.	O	Page No.
Maintenance—Cont'd		Oil, data on	9
duties of using arm personnel—Cont'd		Oil circulation	66
propeller shafts and universal		Oil cleaner, Fram	67
joints	54	Oil filter	
sheet metal	54	description	73
shock and linkage absorber	48	maintenance	73
steering system	54	replacement	74
suspension system	54–55	Oil inhibitor, use of	90
tires	55	Oil pan	71
transfer case	50	Oil pressure	66
transmission	55	Oil pressure gage	
turret	55	description and replacement	109
vehicle assembly	55	location and use	14–15
wheels	55	Oil pressure regulator	66–67
fuel pump	87	Oil pump	
fuel system	82	description	66, 72
oil filter	73	replacement	72
preventive operations	59	screen	72–73
(See also Inspections)		Oilholes, cleaning	34
radiator	91	Open circuits	115
scope of	47	Operation	
Make of engine	58	controls	15–17
Manifolds	70	(See under Controls for specific	
Master cylinder		names)	
clutch	121–122	engine	
description	150–151	stopping	22
replacement	84–85, 151	test	21
Materiel affectedd by chemicals (See		gearshift lever	127
Chemicals, materiel affected by)		inspection after	29–30
Maximum allowable speeds	10	500 miles	30–31
Metal parts exposed to gas	45	5,000 miles	31–32
Missing cylinders, test for	29	inspection during	28–29
Motor Book, use of	34	instrument panel (See Instrument	
Motor mounts	70	panel)	
Mountings, engine	59	operating the vehicle	21–22
Mounts, motor	70	prestarting and inspection.....	18–19
Mustard gas	43	primer	17
N		starting instructions	19–20
No. 1 piston, setting on top dead center		warm and cold weather	20
of compression stroke	78–79	towing the vehicle	22
Noise, abnormal engine	65–66	under unusual conditions	
Nonelectrical instruments		cold weather starting	23
speedometer	116	dusty conditions	24
turret compass		high altitudes	23–24
compensation	116–118	high temperatures	23
description	116	sand	24
Numbering cylinders from rear to		slippery terrain	24
front	59	Organization spare parts	57
		Over-all dimensions	5
		Overheated engine	64

LIGHT ARMORED CAR M8

P	Page No.		Page No.
Packing nut, water pump	92	Rear and intermediate axles	137
Paint(-ing)		Rear axle, maintenance	49
as a camouflage	159-160	Rear springs	138
general discussion of	158	Rear wheel bearings	146
lubricating devices	161	Rebuild defined	48
metal surfaces	159	Records	
preparing for	158-159	tools and accessories	42
removing	160-161	vehicle	34
Performance of engine and vehicle,		Reduction of paint	158
data on	10	Refueling, number of miles without..	9
Periodic inspection		Repaint, when to	160
after 500 miles of operation	30-31	Repair defined	48
after 5,000 miles of operation	31-32	Repairs, fuel pump	87
Periscopes	154	Replace defined	48
Pillow block, description and replace-		Replacement	
ment	126	axles	
Pintle	157	front	135
Pioneer tools	37	shaft	134
Piston displacement	58	rear and intermediate	137
Pitman arm	142	bearings	
Precautions for automotive materiel	46	front	145
Preserving camouflage	160	rear	146
Pressure of tires, inflation	10	bogie bracket	141
Preventive maintenance operations ...	59	bogie shaft bearing	139-140
(See also Inspections)		bogie torque rods	140-141
Primer for metal and wood	159	brakes	
Priming pump		brake shoes	153
description of	89	hydrovac	150
location and operation	17	master cylinder	151
Power, lack of	64-65	slave cylinders	152
Propeller shafts and universal joints		clutch	
description	124	disk and pressure plate	121
maintenance	54	hydraulic lines	123
pillow block	126	master cylinder	121-122
replacement of propeller shafts	124-126	slave cylinder	122
Protective padding, data on	9	cooling system	
Protective vision, data	9	fans	93
Push rods, adjustment	69-70	fan belts	94
		radiator	91
R		thermostat	95
Radiator		water pump	93
description	90-91	drag link	143
maintenance	91	electrical system	
replacement	91	ammeter	112
Radio, data on	9	battery	103
Rations, stowage position of	40	cables	104
Ratio(s)		battery master switch	113
axles	131	blackout driving switch	112
transfer case	129	circuit breakers	110

INDEX

R—Cont'd	Page No.	Page No.
Replacement—Cont'd		
electrical system—Cont'd		
conduit and cables	114	
fire detector bulb and button	109	
fuel level gage	113	
generator	102	
generator regulator	103	
instrument panel	108	
instrument panel light		
rheostat switch	112	
lamps		
blackout bulb	107	
head lamp bulb	105	
tail lamp	107	
light switch	111	
oil pressure gage	109	
siren	110	
push button	111	
starter switch button	110	
starting motor	104	
starting solenoid	105	
voltmeter	108–109	
water temperature gage	108	
engine		
cylinder head	73	
installation	68	
manifolds	70	
motor mounts	70	
oil filter assembly	74	
oil pan	71	
oil pump	72	
removal	67–68	
fuel system		
air cleaners	84	
automatic choke	87	
carburetors	83	
fuel filter	88	
fuel pump	87–88	
fuel tank	88	
ignition system		
distributor	77–78	
ignition coil	76–77	
ignition switch	76	
propeller shafts	124–126	
pillow block	126	
shock absorbers	141	
speedometer units	116	
spring shackles	139	
springs, front and rear	138	
		steering gear
		142
		tires
		144–145
		transfer case
		129
		transmission
		127–128
		turret
		157
		wheel
		145
		Reverse current relay or cutout
		102–103
		Rheostat switch
		description and replacement
		112
		location and use
		14
		“Right” defined
		11, 59
		Rotation of turret
		3
		Rusting, control of in cooling system
		90
		S
		Sand, operation in
		24
		Seats
		data on
		9
		driver's compartment in turret.....
		156
		Service brake
		adjustment
		149
		controls
		149
		data on
		149
		description
		147
		foot pedal
		15
		Service defined
		47
		Service head lamps
		105
		Servicing the fuel filter
		88
		Setting distributor and timing
		79
		Sheet metal, maintenance
		54
		Shifting
		21
		mechanism
		127
		Shimmy (low speed)
		134
		Shock absorbers
		48, 141
		Short circuits
		114–115
		Sighting equipment carried on
		vehicle
		40–41
		Signaling equipment, stowage posi-
		tion of
		40
		Siren
		110
		Siren push button
		description and replacement
		111
		location and use
		14
		Slave cylinders
		bleeding
		153
		replacement
		85
		Slave (wheel) cylinders
		description
		151
		replacement
		152

LIGHT ARMORED CAR M8

S—Cont'd

Page No.

Page No.

Slippery terrain, operation in	24
"Slurry," use of in decontamination....	45
Spare parts, organization	57
Spark control	15
Spark plugs	
general discussion of	80
no spark at one or more	62-63
Special tools and equipment	56
Specific gravity test of battery	103
Speedometer	
description and replacement	116
location and use	14
Speeds, maximum allowable	10
Spring shackles	139
Springs, front and rear	138
Starter switch, location and use	14
Starter switch button	110
Starting motor	104
Starting solenoid	
description	104-105
replacement	105
Starting system	104
Starting the engine	
cold weather	23
prestarting	19
warm and cold weather	20
Steering gear	
description and data	142
drag link	142-143
pitman arm	142
replacement	142
Steering system, maintenance	54
Steering the vehicle	3
Steering troubles	133
Steering wheel	15
Stenciling used on vehicle	160
Stopping the engine and vehicle	22
Stowage	
ammunition	27
position of equipment (See Equip- ment and tools on vehicle)	
Stroke of engine	58
Suspension system, maintenance ..	54-55
Switches (See <i>specific names</i>)	

T

Tabulated data (See Data)	
Tail lamp	107
Telephone, data on	9

Test	
engine	21
missing cylinders	29
specific gravity of battery	103
Thermostat	
description	94-95
replacement	95
Throttle control	
bleeding	86-87
description and adjustment	84
hydraulic fluid reservoir	85-86
hydraulic lines	86
master cylinder	84-85
slave cylinder	85
Tie rod (front axle)	135
Timing, ignition	78-79
Tires	
data on	10
description and data	144
maintenance	55
replacement	144-145
Toe-in of front wheels	135
Tools, special	56
(See also Equipment and tools on vehicle)	
Top dead center of compression stroke, setting No. 1 piston on	78-79
Torque rods, bogie	140-141
Towing the vehicle	22
Transfer case	
description and data	129
gear ratio selecting lever	17
maintenance	50
operation of controls	15-17
replacement	129
Transmission	
description and data	127
maintenance	55
replacement	127-128
Transmission end defined	59
Traversing 37-mm gun	25
Tread, data on	5
Trouble shooting	
electrical system	114-115
engine	61-66
generating system	99-101
ignition system	63
wheel alinement	131-134

INDEX

T—Cont'd

Page No.

Page No.

Turning radius, data on	5
Turns, negotiating	22
Turret	
data on	9
description	156
maintenance	55
removal and installation	157
rotation	3
seats	156
(See also Hull and turret)	

U

Uneven running of engine, cause and remedy	63-64
Universal joints (See Propeller shafts and universal joints)	
Unmounted guns	25
Unusual conditions, operation under (See under unusual conditions under Operation)	
Using arm personnel (See duties of using arm personnel under maintenance)	

V

Valve mechanism	69-70
Valve minimum clearance	59
Valves and valve push rods	69
Vehicle	
description	3

limitations of	10
Vehicle assembly, maintenance	55
Vehicular tools	37-39
Vesicant casualties	44
Vision devices	154
Voltage regulator	102
Voltmeter	
description	108
location and use	12
replacement	108-109

W

Warm weather starting of engine	20
Water pump	
description	92
packing	92
replacement	93
Water temperature gage	108
Weight of engine	5
Wheel alinement	
specifications	131
trouble shooting	131-134
Wheel base, data on	5
Wheels	
description and data	144
maintenance	55
replacement	145
Wires, high tension	80
Wiring	115

LIGHT ARMORED CAR M8

[A.G. 062.11 (3-10-43)
O.O. 461/36321 O.O. (3-10-43)]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

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J. A. ULIO,
Major General,
The Adjutant General.

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(For explanation of symbols, see FM 21-6)